A review of the Macrochelidae (Acari: Mesostigmata) of the British Isles

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This paper is dedicated to Ernest Browning, M.B.E., who died on the 1st September 1987, aged 91

Contents

Synopsis

Thirty-two species of mites of the family Macrochelidae are now known to occur in the British Isles. Descriptions are given for the nine species, including one new to science, recorded for the first time, and for other selected species. Habitat and distributional data are given and keys to the genera and species for adults are provided. Two neotypes and four lectotypes are newly designated. The genus *Dissoloncha* Falconer, 1923 is resurrected and four specific names are newly synonymized.

Introduction

It is over thirty years since the publication by Evans & Browning (1956) of their work on the British Macrochelinae (now generally treated as the family Macrochelidae). This work was a turning point in the taxonomic study of the Macrochelidae. For the first time it was relatively easy to identify many of the common macrochelids, not only of the British Isles but also of northern Europe and to some extent further afield. It was also the first substantial revisionary work on European macrochelids since that of Berlese (1918).

In the intervening time our knowledge of all aspects of macrochelids has increased rapidly. Their role as predators of the eggs and larvae of synanthropic flies has been fully realised, and steps taken to make practical use of this knowledge. In connection with this, detailed studies of the biology of

*The first part of this work was done whilst on leave based at the British Museum (Natural History).

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some species have been undertaken. Taxonomic work has proceeded at all levels within the family both in Europe and elsewhere. Generic concepts have changed, many new species have been described and the type specimens of old species re-examined. Groups of closely related species have been recognised and in some cases distinguished with the help of breeding experiments.

It therefore seems appropriate to apply this new understanding of the group to the fauna of the British Isles, particularly as part of the acarine collection of the Rev. J. E. Hull, containing some of his type material of British macrochelids, has been found and is now housed in the Arachnida collections of the British Museum (Natural History).

Evans & Browning (1956) recorded and gave descriptions of twenty-three species of Macrochelidae. It now seems likely that at least one and probably two of the species recorded by them are not members of the British fauna. The inclusion of these species was based on old records and no British material was seen by Evans & Browning or in the extensive collections examined in the present study. The names of seven previously recorded species must be changed. In all, nine species, one previously undescribed, are reported from the British Isles for the first time.

Since the main purpose of this work is to bring our knowledge of the British Macrochelidae up to date, species described in detail by Evans & Browning are not redescribed here although amendments are made where necessary. However, species not previously recorded are described fully. All the species are figured; those previously recorded are illustrated, with some minor amendments, from the original figures of Evans & Browning, since that paper has been out of print for many years, whilst those recorded for the first time are newly illustrated. Notes on morphology and classification are included and keys to genera, species groups and species are provided.

Material examined

The primary source of material on which this study is based is the large collection of Macrochelidae preserved in the collections of the British Museum (Natural History). Over five and a half thousand specimens have been examined. All the locality information for the British Isles is based on this material, except where otherwise noted.

In addition, macrochelid material in the Berlese Collection, Istituto Sperimentale per la Zoologia Agraria, Firenze, was examined. This was mainly for type material of species occurring in the British Isles, but much other material, particularly of European species, was also examined.

Type material of species described by Bregetova & Koroleva (1960) was borrowed from the Institute of Zoology of the Academy of Sciences, in Leningrad and parts of the extensive collection of North American and tropical macrochelids in the Department of Entomology, Oregon State University, Corvallis, were also examined.

The following abbreviations appear in the text:

BMNH:	British Museum (Natural History)
ISZA:	Berlese Collection, Istituto Sperimentale per la Zoologia Agraria, Firenze, Italy.
ZINL:	Institute of Zoology, Academy of Sciences, Leningrad, U.S.S.R.
OSUC:	Entomology Department, Oregon State University, Corvallis, U.S.A.

Morphology

A detailed study of the morphology of *Glyptholaspis confusa* (Foà) has been published by van der Hammen (1964), but not all of his interpretations would be accepted by all workers on Mesostigmata (Evans & Till, 1965). In general the terminology used here follows Evans & Till (1979).

Idiosoma

Dorsum

The system of setal nomenclature used here was first developed by Lindquist & Evans (1965) for the Ascidae and has since been widely applied to other groups of gamasine Mesostigmata. The relationships between the setal nomenclature used by Evans & Browning (1956) and that used here are shown in Figure 1A and further compared in Table 1 with those of Bregetova & Koroleva (1960) and Hirschmann (1957), both of which have been used by various authors. More recently Halliday (1986) has compared in detail the various systems of dorsal setal nomenclature used in the Macrochelidae and has advocated that of Lindquist & Evans (1965) for general application in this family.

The number of setae on the dorsal shield in British species is remarkably constant, varying from 56–60, but usually expressed as 28 regularly arranged pairs (Fig. 1A). The major exception to this arrangement is in the *opacus* species group of *Macrocheles* (the former genus *Macrholaspis* Oudemans) which always have setae *J3* present instead of *J2* and, in addition have 1–4 setae, often asymmetrically arranged between *j6* and *J3*. *M. montanus* (Willman) has both *J2* and *J3* present giving 29 pairs and *Glyptholaspis confusa* typically has one or two small asymmetric setae between *j6* and *J2*. The situation in *Geholaspis* Berlese is more difficult to interpret. It has the usual 28 pairs of setae but *j5* and *j6* appear to have migrated posteriorly from their usual positions.

Venter

The form and ornamentation of the sternal shield have been used as one of the main characters to distinguish the genus *Glyptholaspis* Fillipponi & Pegazzano from *Macrocheles*, whilst the pattern of lines described by Berlese (1918) is very useful in distinguishing species and species groups of *Macrocheles* (Fig. 1B).

The setal nomenclature system of Lindquist & Evans (1965) is used for the opisthogaster. The setation of the ventrianal shield is now known to be more variable than previously realised. *Holostaspella* Berlese may have three or four pairs of setae, *Zv1* lying either on or off the ventrianal shield. In all British species it is on the shield (Fig. 22D). The *opacus* species group of *Macrocheles*, previously recognised as a separate genus, *Macrholaspis*, largely on the basis of only having *Jv2*

Table 1 Chaetotaxy of the dorsal shield.

Dorsocentral series				Mediolateral series				Lateral series				Marginal series			
L&E	E&B	B&K	H	L&E	E&B	B&K	H	L&E	E&B	B&K	H	L&E	E&B	B&K	H
						Anterior region (podonotum)									
j1	*D1*	*F1*	*i1*	*z1*	*M1*	*F2*	*r1*	—	—	—	—	—	—	—	—
j2	*D2*	*F3*	*s1*	*z2*	*M2*	*T1*	*s2*	*s2*	*L1*	*S1*	*r3*	*r2*	*Mg1*	*M1*	*r4*
j3	*D3*	*V*	*i2*	—	—	—	—	—	—	—	—	*r3*	*Mg2*	*M2*	*r5*
j4	*D4*	*D1*	*i3*	*z4*	*L2*	*Sc*	*z1*	*s4*	*Mg3*	*S2*	*s5*	*r4*	*Mg4*	*M3*	*r7*
j5	*D5*	*D2*	*i4*	*z5*	*M3*	*D3*	*z2*	*s5*	*L3*	*S3*	*s6*	—	—	—	—
j6	*D6*	*D4*	*i5*	*z6*	*M4*	*I1*	*z3*	*s6*	*Mg5*	*M4*	*s7*	—	—	—	—
						Posterior region (opisthonotum)									
—	—	—	—	*Z1*	*L4*	*S4*	*Z1*	*S1*	*Mg6*	*M6*	*S1*				
J2	*D7*	*D6*	*J1*	*Z2*	*L5*	*S6*	*Z2*	*S2*	*Mg7*	*M8*	*S2*				
J3	—	*D7*	*J2*	—	—	—	—	—	—	—	—				
—	—	—	—	*Z4*	*L6*	*S7*	*Z3*	*S4*	*Mg8*	*M9*	*S3*				
J5	*D8*	*S8*	*J5*	*Z5*	*Mg10*	*M11*	*S5*	*S5*	*Mg9*	*M10*	*S4*				

L & E = Lindquist & Evans (1965) B & K = Bregetova & Koroleva (1960)
E & B = Evans & Browning (1956) H = Hirschmann (1957)

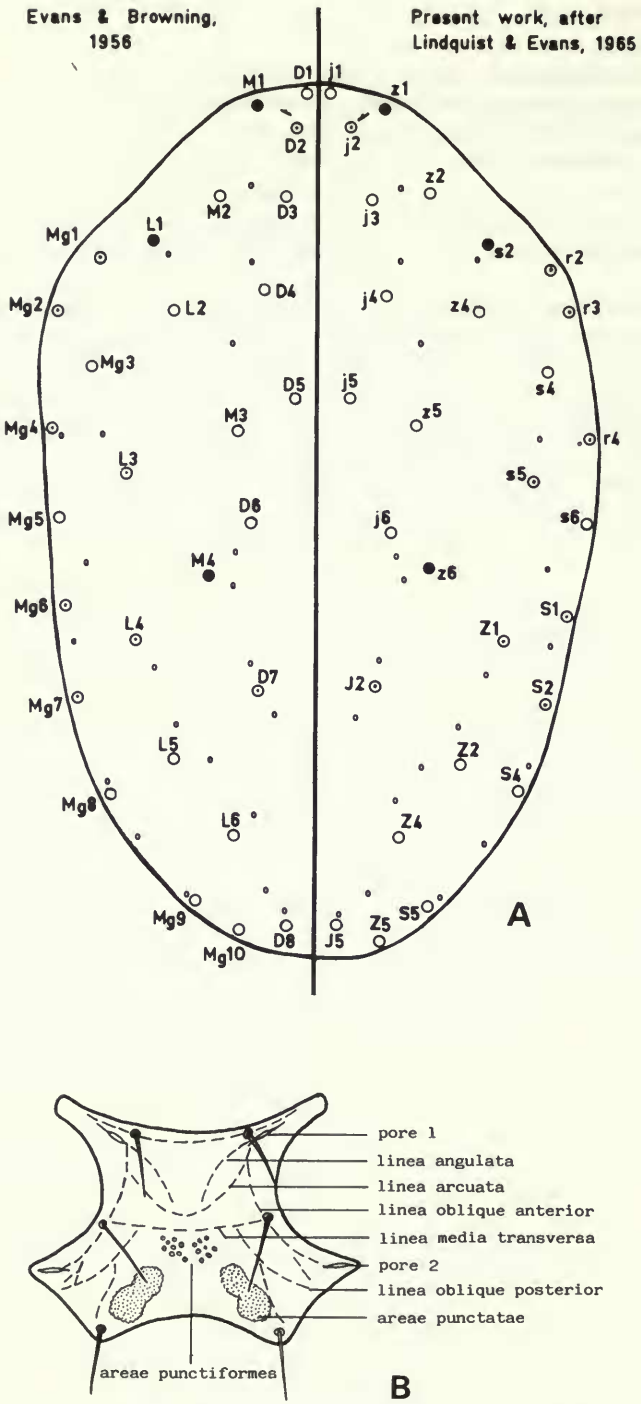


Fig. 1 A dorsal chaetotaxy of *Macrocheles* sp. comparing the systems of Evans & Browning (1956) and the present work, after Lindquist & Evans (1965); B structure and ornamentation of the sternal shield in the Macrochelidae, based on Berlese (1918).

and *Jv3* on the ventrianal shield, has been found to be much more variable. Species exist without any of the *Jv* series on the sclerotised part of the venter (Fig. 13B) and others with *Jv3*, or *Jv2* and *3* or *Jv1–3* on the ventrianal shield (Fig. 3B).

The distribution and type of pore-like structures in the Gamasina has been studied by Athias-Henriot (1969). The inguinal pores occur in the anterolateral corners of the ventrianal shield in *Geholaspis* and *Dissoloncha* Falconer, but are free on the membrane in *Macrocheles, Glyptholaspis* and *Holostaspella.*

In the genus *Glyptholaspis* all males have holoventral shields, whilst in *Dissoloncha* the males have separate sternogenital and ventrianal shields. In *Macrocheles* and *Holostaspella* the males have either separate sternogenital and ventrianal shields or holoventral shields.

Gnathosoma

The terminology used is that of Evans & Till (1979). The chaetotaxy of the pedipalps has been investigated by Evans (1964). The numbers and positions of setae in the Macrochelidae are quite typical for the free-living Gamasina having 2–5–6–15–15 setae on the trochanter, femur, genu, tibia and tarsus respectively.

The form and length of the brush-like outgrowths of the cheliceral arthrodial membrane are important at the generic level, although they do not vary much in the British species. The form of the cheliceral dorsal seta is of use in distinguishing species groups in *Macrocheles*. The shape of the gnathotectum is of importance at the generic level and for species groups in *Macrocheles* (Figs 2B, 7B, 13B).

Legs

Leg I is without ambulacral apparatus in all British species although species with pulvilli in the adults and pulvilli and claws in the immature stages have been assigned to the macrochelid genus *Neopodocinum* Oudemans by Krantz (1965).

The leg setation of the Gamasina has been studied by Evans (1963). Macrochelids have a remarkably constant pattern of leg setation (Table 2). The only variation known in species from the

Table 2 Numbers of setae on leg segments in the Macrochelidae.

legs	I	II	III	IV
coxa	2	2	2	1
trochanter	$1-\frac{0}{3}-1$	$1-\frac{0}{3}-1$	$1-\frac{0}{3}-1$	$1-\frac{0}{3}-1$
			or $1-\frac{0}{2}-1$	
femur	$2-\frac{5}{4}-2$	$2-\frac{5}{3}-1$	$1-\frac{0}{2}-1$	$1-\frac{3}{1}-1$
genu	$2-\frac{3}{1},\frac{2}{1}-2$	$2-\frac{3}{1},\frac{2}{1}-2$	$1-\frac{2}{1},\frac{2}{0}-1$	$1-\frac{2}{1},\frac{2}{0}-0$
				or $1-\frac{2}{1},\frac{2}{0}-1$
tibia	$2-\frac{3}{2},\frac{2}{1}-2$	$2-\frac{2}{1},\frac{2}{1}-2$	$1-\frac{1}{1},\frac{2}{1}-1$	$1-\frac{1}{1},\frac{2}{1}-1$
tarsus	—	18	18	18

British Isles is in genu IV which has seven setae in *M. subbadius*, seta pl_1 being present, instead of the usual six setae. This condition is also found in a few other species of *Macrocheles* and in the mainly tropical genera *Holocelaeno* Berlese and *Neopodocinum*. The genus *Neopodocinum* also has only four setae on trochanter III instead of the usual five due to the absence of one of the ventral setae.

The distribution of spurs on the legs of male macrochelids is useful at the generic level; *Glyptholaspis* having spurs on legs II, III and IV, *Macrocheles* on legs II and often on legs IV and *Holostaspella* only on femur II, if at all. The form and precise distribution of these spurs is also useful in distinguishing closely related species, as are the spurs on leg II of female *Holostaspella*.

Spermathecal structures

Recently there have been a number of studies on the method of insemination of gamasine mites and of the spermathecal structures. The information derived from this work has proved to be useful at all levels of classification in the Gamasina.

There appear to be two basic types of insemination (Athias-Henriot, 1968), vaginal, or tocospermic, in which insemination is via a median endogynal, cuticular sac and podospermic where it is via tubular cuticular invaginations associated with the bases of legs III or IV. In the British Gamasina, tocospermic insemination is found only in the families Parasitidae, Epicriidae and Zerconidae. Podospermic insemination is characteristic of other gamasine groups.

Within the podospermic group two main variations of the spermathecal structures (Michael's organ) are found, the tubular cuticular invaginations may lead either to paired terminal organs (phytoseiid type) or to a single median organ (laelapid type). Paired spermathecal structures are found in the Phytoseiidae and some genera of the Ascidae (*sensu* Lindquist & Evans, 1965), median spermathecal structures are found in most other families of the Gamasina, including the Macrochelidae.

The spermathecal complex has been described for a number of species of European Macrochelidae (Petrova, 1960; Costa, 1966*a*, 1967; Athias-Henriot, 1968) and provides good taxonomic characters at the generic and species level.

The opening, or solenostome, of the *tubulus annulatus*, is always on the posterior basal margin of coxa III. In *Macrocheles* the infundibulum is well developed, the rami are usually short and the sacculus generally consists of two, more or less, spherical lobes broadly joined by a tubular section which gives rise to the corniculum posteriorly (Fig. 14F). In a few species the sacculus is unlobed, spherical and merges into the corniculum to give an overall pear-shaped median organ (Costa, 1967). *Dissoloncha superbus* has a very different sacculus from all other species of Macrochelidae: it is large, more or less spherical and strongly convoluted.

Classification

Evans & Browning (1956) recognised two subfamilies of Macrochelidae, the Macrochelinae Trägårdh, 1949 (*sic*) and the Areolaspinae Trägårdh, 1952, based mainly on the patterns of fusion of the ventral shields. Subsequently Evans (1956), in a radical reappraisal of the classification, taking into account the great variation shown in the ventral shields, proposed a new classification based on characters of the peritreme, gnathotectum, genital sclerotisation and gnathosoma. In this classification the family was split into the Macrochelinae Trägårdh (*sic*) and the Parholaspinae Evans 1956 (*Areolaspis* having been shown to be closely allied to other macrocheline genera).

Krantz (1969) regarded the two groups as distinct families, as have most subsequent authors, but see Karg (1971) and Krauss (1970). Evans' (1956) definition of the group, however, remains almost unchanged.

About sixteen genera of Macrochelidae are distinguished at present, of which only five occur in the British Isles. There has been some change in generic limits affecting these genera during the last thirty years.

Macrholaspis is now generally regarded as a synonym of *Macrocheles* (Krantz, 1962) following

recognition of species closely related to the type species, *Gamasus opacus* C. L. Koch, with three pairs of setae on the ventrianal shield and lacking denticulate margins to the dorsal shield.

The genus *Glyptholaspis* has been split off from *Macrocheles* to contain several species, including two formerly confused under the name *M. plumiventris* Hull, in the British fauna. The main distinguishing features of the genus are the posterior extension of the sternal shields, the crenulate reticular pattern of the main shields and the presence of spurs on legs II, III and IV in the male. The genus *Dissoloncha* Falconer is here resurrected for *M. superbus* Hull, which is shown to share characters of the gnathosoma and other features with *Geholaspis* and to be isolated from *Macrocheles* s. str.

The generic limits of *Holastaspella* have been widened to include species without seta *Zv1* on the ventrianal shield* and a greater range of variation in the form of the ventral sclerotisation.

Geholaspis remains essentially unchanged although some authors give the subgenus *Longicheles* Valle full generic status (Athias-Henriot, 1968).

A number of species groups have been distinguished in the genus *Macrocheles* following the work of Filipponi & Pegazzano (1962, 1963) on closely related species. This concept has been extended by Krantz (1972) and is also used here.

Key to the genera of Macrochelidae occurring in the British Isles

1 Femur II armed with a sclerotised spur in the female, seta *mv* of tarsus II modified into a thick spine (Fig. 22B); vertical setae inserted on an anterior projection of the dorsal shield (Fig. 22A). British species with four pairs of preanal setae on the female ventrianal shield . . . . . ***HOLOSTASPELLA*** Berlese (p. 118)

– Femur II unarmed in the female, seta *mv* of tarsus II unmodified; without anterior projection of the dorsal shield. British species never with four pairs of preanal setae 2

2 Ventrianal shield with inguinal pores on anterolateral corners; gnathotectum lacking lateral processes (Figs 2B, 4E); corniculi three or more time longer than broad (Fig. 3C) 3

– Inguinal pores free on post-coxal membrane; gnathotectum with free or fused lateral processes (Fig. 7B, D); corniculi no more than twice as long as broad, or if gnathotectum without lateral processes and corniculi elongate then with anal shield only (Fig. 13B). 4

3 Ventrianal shield with five pairs of preanal setae; terrestrial litter species . . . . . ***GEHOLASPIS*** Berlese (p. 69)

– Ventrianal shield with three pairs of preanal setae; seashore species . . . . . ***DISSOLONCHA*** Falconer (p. 76)

4 Sternal shield with characteristic reticulate pattern (Pl. 3C), extending posterolaterally to level of posterior margins of coxae III; legs II–IV of males armed with spurs . . . . . ***GLYPTHOLASPIS*** Filipponi & Pegazzano (p. 114)

– Sternal shield variously ornamented but never similar to the above, not produced posterolaterally beyond the middle of coxae III; legs II and sometimes IV, but not III, armed with spurs and tubercles in the male . . . . . ***MACROCHELES*** Latreille (p. 78)

Genus ***GEHOLASPIS*** Berlese

Geholaspis Berlese, 1918. *Redia* **13**: 145.

TYPE SPECIES. *Gamasus longispinosus* Kramer, 1876.

The dorsal shield has 28 pairs of setae which are mostly pilose or plumose distally. The ventral setae are mostly simple except towards the posterior lateral margins. The sternal and genital shields are similar to those of *Macrocheles*, but the metasternal plates may be free or fused to the endopodal shields (subgenus *Cyrtocheles* Valle). The ventrianal shield has five pairs of preanal setae and bears the inguinal pores (Athias-Henriot, 1969) in the anterolateral corners. Males, where known, have

*It should be noted that contrary to the statement and figures of Krantz (1967), *H. sculpta* Berlese, the type species of *Holostaspella*, in fact lacks setae *Zv1* on the ventrianal shield (Filipponi & Pegazzano, 1967, and personal observation of R.M.E.).

holoventral shields. The gnathotectum has an elongate median process that may be toothed or bifurcate distally and dentate laterally. The chelicerae may be either short (*Geholaspis* s. str. and *Cyrtocheles*) with basically tridentate fixed chelae and bidentate movable chelae, or very elongate (*Longicheles* Valle) and multidentate. The spermatodactyl is short and dorsally directed. The corniculi are elongate, more than three times as long as broad and the external hypostomal setae are anterior to the internals. The males have a small spur on femur II.

The setation of the dorsum varies from the usual condition as seen in *Macrocheles* (Fig. 1A) in that setae *j5* are displaced posteriorly, so as to lie mesad and only slightly anterior of *j6* in subgenera *Geholaspis* s. str. (Figs 2A, 3A) and *Cyrtocheles* and considerably posterior to setae *j6* in subgenus *Longicheles* (Figs 4A, 5A). This latter position is associated with a posterior projection of the podonotal shield in the protonymphs and is no doubt a consequence of a posterior migration of the cheliceral retractor muscles, associated with the massive development of the chelicerae in this subgenus.

Key to subgenera and species of *Geholaspis* s. lat. recorded from the British Isles

1 Cheliceral digits short, with not more than 5 teeth (Fig. 2C); gnathotectum more or less triangular, median process with prominent lateral projections (Fig. 2B) Subgenus ***GEHOLASPIS*** s. str. 2
– Cheliceral digits prominently elongate, multidentate, movable digit with 10 or more teeth (Fig. 4F); gnathotectum with median process parallel sided, bifurcate distally (Fig. 4E) . . . . . Subgenus ***LONGICHELES*** Valle 3
2 Dorsal setae less than 100 μm in length; ventrianal shield only slightly wider than long (Pl. 4A). . . . . ***Geholaspis (G.) longispinosus*** (Kramer) (p. 70)
– Dorsal setae generally exceeding 150 μm in length; ventrianal shield conspicuously wider than long (Fig. 3B) . . . . . ***Geholaspis (G.) aeneus*** Krauss (p. 71)
3 Setae *z5* simple (Fig. 4A); median process of gnathotectum smooth or minutely denticulate behind terminal bifurcation (Fig. 4E); ventrianal shield almost as broad as or broader than long (Fig. 4B–D) . . . . . ***Geholaspis (L.) mandibularis*** (Berlese) (p. 74)
– Setae *z5* plumose, *j6* serrate or simple (Fig. 5A); median process of tectum strongly toothed behind terminal bifurcation (Fig. 5C); ventrianal shield noticeably longer than broad (Fig. 5B) . . . . . ***Geholaspis (L.) hortorum*** (Berlese) (p. 74)

Geholaspis (Geholaspis) longispinosus (Kramer)
(Fig. 2A–C, Pl. 4A)

The description and synonymy given by Evans & Browning (1956) are unchanged.

MATERIAL EXAMINED. 127 collections—4 PNN, 16 DNN, numerous ♀♀.

ENGLAND: Isles of Scilly, Cornwall, Devon, Somerset, Dorset, Gloucestershire, Hampshire, Sussex, Surrey, London, Kent, Essex, Cambridgeshire (including Huntingdonshire), Norfolk, Suffolk, Hertfordshire, Berkshire, Buckinghamshire, Worcestershire, Warwickshire, Lincolnshire, Yorkshire, Cumbria (Cumberland and Westmorland), Northumberland.

SCOTLAND: Strathclyde (Argyllshire), Dumfries & Galloway (Wigtownshire), Tayside (Perthshire), Highland (Inverness-shire, Wester Ross), Inner Hebrides (Mull, Ulva), Shetland.

WALES: Glamorgan, Gwent, Gwynedd (Merionethshire and Caernarvonshire), Clwyd (Denbighshire).

IRELAND: Clare, Westmeath, Galway, Mayo, Leitrim.

CHANNEL ISLANDS: Jersey.

HABITATS. Found in all sorts of forest leaf litter, among dead grass and other decaying vegetation, also in moss. Bregetova & Koroleva (1960) also have records from small mammal nests.

DISTRIBUTION. One of the commonest European macrochelids, found throughout the British Isles and Europe generally (Valle, 1953; Balogh, 1958; Bregetova & Koroleva, 1960; Halaskova & Kunst, 1960; Johnston, 1970; Krantz, 1972). Emberson (1973*a*) has reported the species from New Zealand where it is presumably adventive.

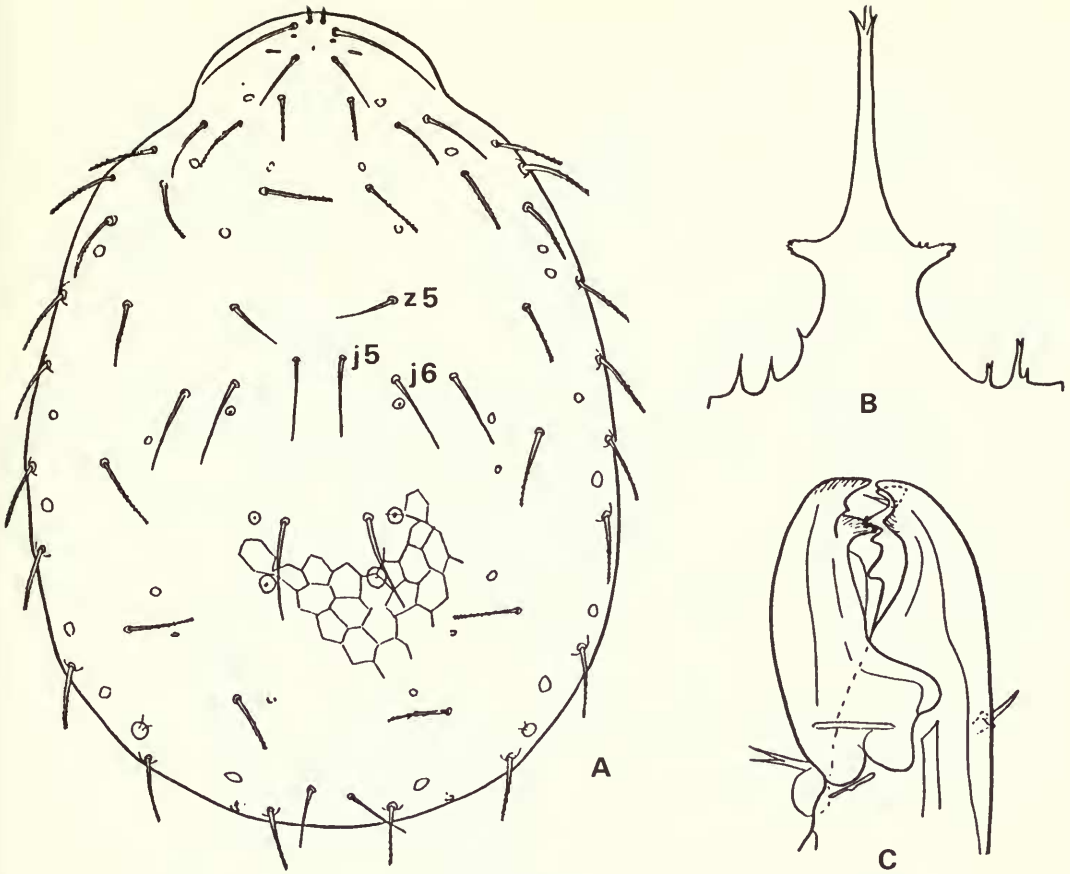


Fig. 2 *Geholaspis (G.) longispinosus* (Kramer): **female**—A dorsal shield; B gnathotectum; C chelicera. After Evans & Browning (1956).

Geholaspis (Geholaspis) aeneus Krauss
(Fig. 3A–C)

Geholaspis (Geholaspis) aeneus Krauss, 1970. *Acarologie* **14:** 38.

FEMALE. The dorsal shield (Fig. 3A) measures 1130 μm long × 840 μm wide (Krauss gives 1050 μm × 750 μm) and is finely granular. The posterior half is covered by a finely regular reticulated pattern, whilst anteriorly it is punctate-reticulate towards the lateral margins. There are 28 pairs of setae. With the exception of setae *j1, z1* and *J5*, all exceed 150 μm in length. The majority are finely pilose, at least in their distal halves. The dorsal pores are conspicuous.

The ventral ornamentation and chaetotaxy are shown in figure 3B. The sternal shield has a characteristic reticulate pattern. The metasternal plates are free. The genital and ventrianal shields have strong reticulate ornamentation. The ventrianal shield (460 μm long × 630 μm wide) is conspicuously wider than long and the preanal setae appear to be simple.

The venter of the gnathosoma is shown in figure 3C. The corniculi measure *c.* 140 μm in length, and the setae appear simple. The chelicerae and gnathotectum are not visible in the only specimen available for study. The leg setae are normal for the genus. The majority are pilose, whilst those on tarsus I and distally on the remaining tarsi are simple.

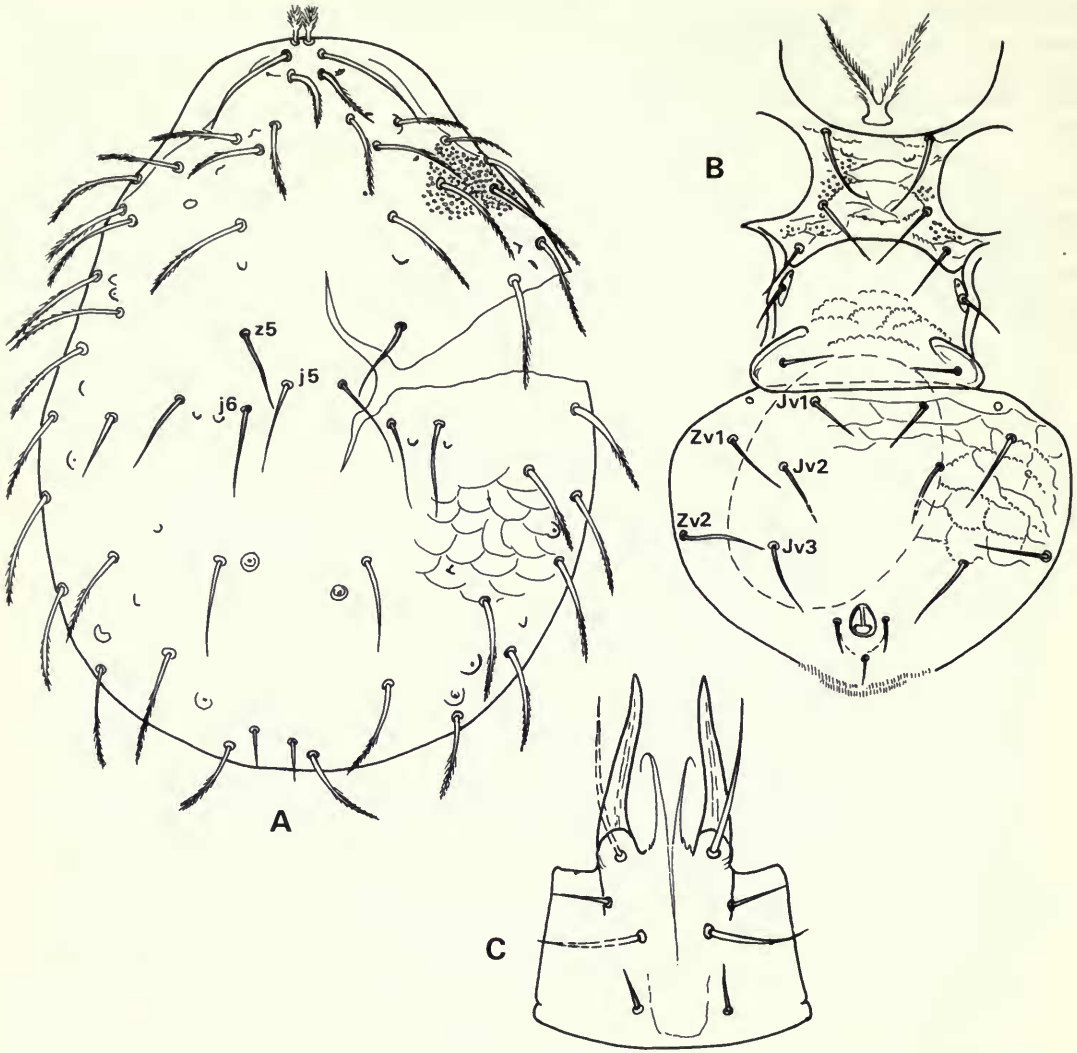


Fig. 3 *Geholaspis (G.) aeneus* Krauss: **female**—A dorsal shield; B ventral sclerotisation; C venter of gnathosoma.

MATERIAL EXAMINED. 1 collection—1♀, in moss.
IRELAND: Mayo. See below.
This is the first British record.

REMARKS. This species was described from protonymph, deutonymph and female stages collected at Valle de Lozera, Puento de Lozera (600 m), Lugo Province, in northwest Spain (Krauss, 1970). The habitat is given as the foot of an old sweet chestnut *Castanea sativa* tree and an oak *Quercus toza* tree in a dry river-bed. We have tried to obtain specimens, but have been informed by Dr W. Hirschmann that Dr Krauss (pers. comm.) has no specimens in his possession.

The Halbert collection contains a single slide preparation labelled '*Holostaspis longispinosus* (Kram.), 1♀, Clare Island, in moss, III/1910'. The idiosoma of this specimen has been damaged on the slide and it is felt at present inadvisable to dismount it. However, the dorsal and ventral chaetotaxy and the venter of the gnathosoma are clearly discernible.

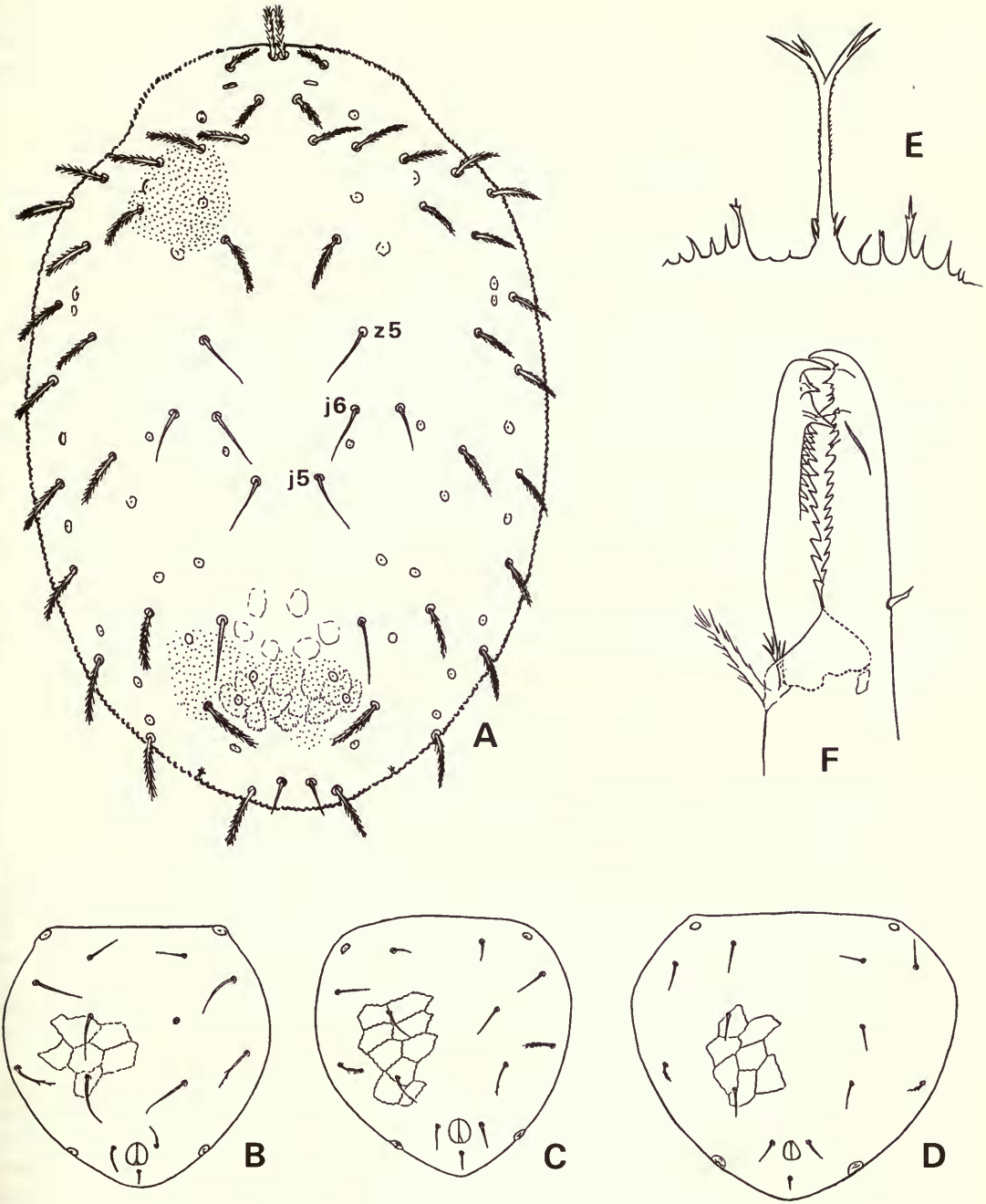


Fig. 4 *Geholaspis (Longicheles) mandibularis* (Berlese): **female**—A dorsal shield; B–D variation in the form of the ventrianal shield; E gnathotectum, F chelicera. After Evans & Browning (1956).

Geholaspis (Longicheles) longulus (Berlese)

The presence of this species in the British Isles is now doubtful. The discovery of a specimen in the Hull Collection with the data '*Macrocheles longulus* dead fowl' is probably the one mentioned (Hull, 1918) as being caught 'at one of my carrion traps'. This is a specimen of *G. longispinosus*. The specimens recorded by Halbert (1915) from Clare Island, Mulranny and Castlebar, all in Co. Mayo, have been examined and are *G. mandibularis*.

Geholaspis (Longicheles) mandibularis (Berlese)
(Fig. 4A–F)

The description and synonymy given by Evans & Browning (1956) do not require amendment.

TYPE MATERIAL. **Holotype** ♀, Cansiglio. Slide 2/34 [ISZA].

MATERIAL EXAMINED. 114 collections—3 PNN, 29 DNN, many ♀♀.

ENGLAND: Isles of Scilly, Cornwall, Somerset, Dorset, Gloucestershire, Hampshire, Surrey, Sussex, London, Kent, Middlesex, Hertfordshire, Suffolk, Cambridgeshire (including Huntingdonshire), Berkshire, Lancashire, Cumbria (Westmorland), Northumberland.

SCOTLAND: Strathclyde (Argyllshire), Dumfries & Galloway (Wigtownshire), Inner Hebrides (Mull, Ulva, Iona), Highland (Ross & Cromarty), Shetland.

WALES: Glamorgan, Gwent, Gwynedd (Merionethshire and Caernarvonshire).

IRELAND: Clare, Sligo, Galway, Mayo, Leitrim, Westmeath.

HABITATS. A wide variety of litter habitats, also turf, soil, moss, ants' nests and nests of small mammals.

DISTRIBUTION. Found throughout the British Isles and widespread in Europe (Valle, 1953). The specimens recorded by Halbert (1915) from Co. Mayo, as *Holostaspis longulus* Berlese, have been examined and are *G. mandibularis*.

Geholaspis (Longicheles) hortorum (Berlese)
(Fig. 5A–D, Pl. 5A)

Holostaspis longulus var. *hortorum* Berlese, 1904. *Redia* **1**: 265.
Macrocheles (Geholaspis) hortorum: Berlese, 1918. *Redia* **13**: 145.
Geholaspis (Longicheles) mandibularis hortorum: Valle, 1953. *Redia* **38**: 349.

FEMALE. Generally very similar to *G. mandibularis* but differing in numerous details. The dorsal shield (Fig. 5A), which measures 770–880 μm long × 440–500 μm wide, is more tapered posteriorly than in *G. mandibularis*. The setae are arranged as in *G. mandibularis*, except that *z5* is plumose and *z6* is occasionally dentate; these setae are simple in *G. mandibularis*. Setae *j5, j6, J2* and *J5* are simple, all other dorsal setae are plumose. In the figured specimen there is, on the left side, an additional seta between and slightly below *S1* and *Z1*. The dorsal shield is ornamented with conspicuous, dense, small denticles which diminish towards the centre of the shield, becoming fine granulation. The lateral margins are crenate.

With the exception of setae *Zv1* and *Zv2* the setae of the ventral shields are simple. The sternal shield has a characteristic reticulate pattern with fine punctures (Pl. 5A). The metasternal platelets are free and ovate. The genital and ventrianal shields have reticulate ornamentation. The ventrianal shield (Fig. 5B) is longer than broad (290–360 μm long × 260–305 μm wide) and has prominent pores at its anterolateral corners and on its posterolateral margin. The ventrianal setae are noticeably shorter than in *G. mandibularis*. Setae *Zv1* are pilose and *Zv2* are plumose. The shield is ornamented with clear reticulation. Only the tubuli and rami of the spermathecal apparatus are normally visible.

The gnathotectum (Fig. 5C) has the median process bifurcate and almost fimbriate distally; posterior to the bifurcation the process is distinctly toothed while basally there is a series of irregular lateral teeth. The cheliceral dorsal seta is simple. The chelae are elongate and multidentate (Fig. 5D). The fixed chela has a main row of about 10–15 teeth with the third or fourth tooth from

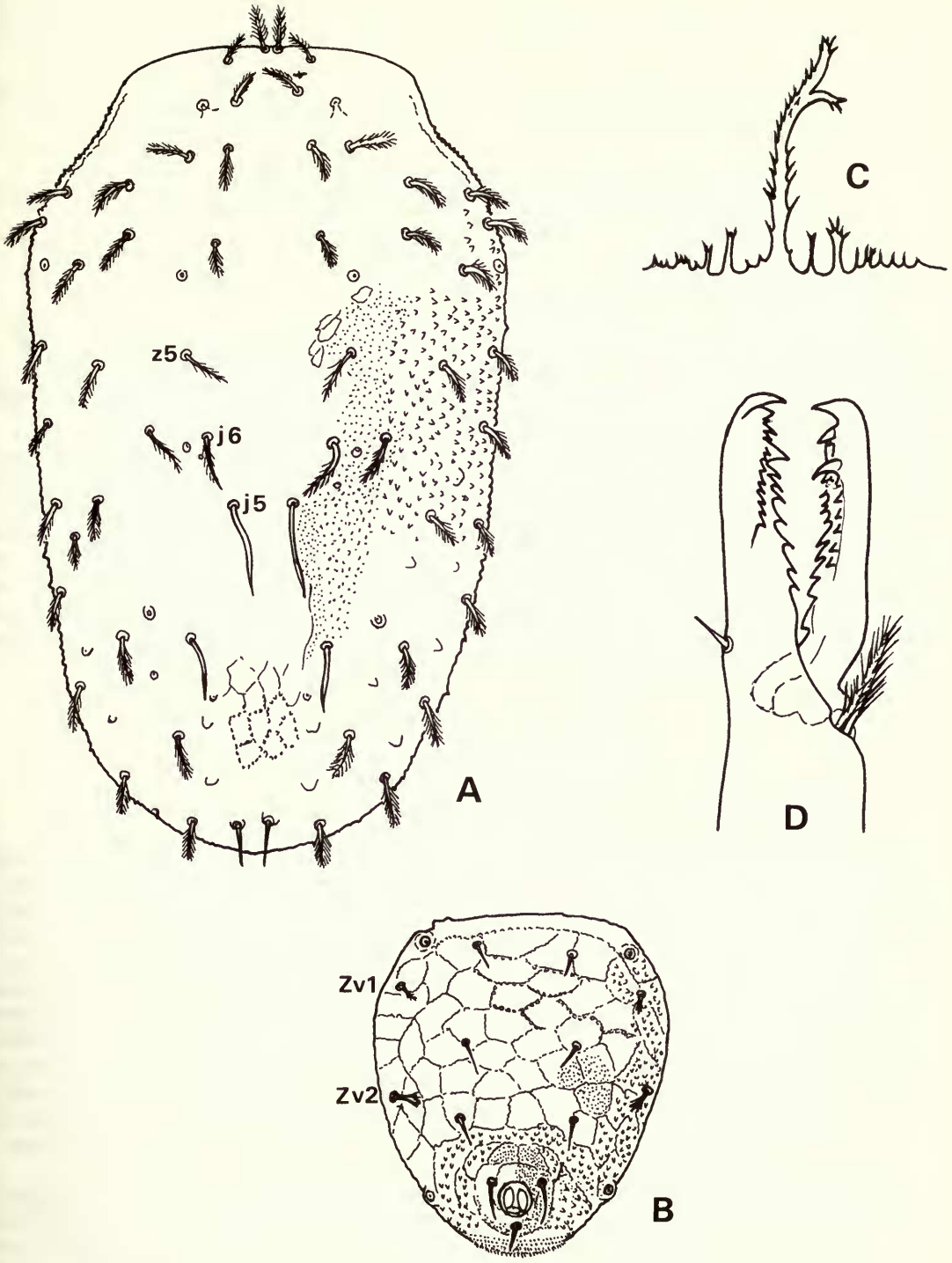


Fig. 5 *Geholaspis (Longicheles) hortorum* (Berlese): **female**—A dorsal shield; B ventrianal shield; C gnathotectum; D chelicera.

the distal end noticeably larger than the others and a subsidiary row of 6 or 8 teeth on the exterior face extending posteriorly from the large tooth. The movable chela (*c.* 198 μm) has a main row of about nine teeth with the second noticeably larger, whilst there is a subsidiary outer row of about 5–6 teeth.

Most leg setae are pilose, except for those on tarsus I, the distal part of tarsi II–IV, and the setae on coxae I and II, trochanters I and II and ventrally on femora I and II.

MALE. Unknown.

TYPE MATERIAL. Not seen, identification based on Valle's (1953) redescription of Berlese's type material.

MATERIAL EXAMINED. 8 collections—1 PN, 1 DN, 13 ♀♀.
ENGLAND: Yorkshire.

HABITAT. The first British record. From semi-natural grasslands in the Yorkshire Wolds.

DISTRIBUTION. Valle (1953) lists material from Italy, Switzerland, Austria, Belgium, Iceland and Germany, however it was not reported from Germany by Karg (1971) or Krauss (1970).

REMARKS. This species is most clearly separated from *G. mandibularis* on the setation of the dorsal shield, the longer than broad ventrianal shield, details of the gnathotectum and the dentition of the chelicerae, which in British specimens of *G. mandibularis* are characterised by more numerous (fixed chela 18–20 teeth, movable chela 14–15 teeth) and smaller teeth, the fixed chela also lacks the clear subsidiary row of teeth found in *G. hortorum*. There seems to be considerable variation in the cheliceral dentition in continental specimens of both species and a complex of forms could be involved. Since *G. hortorum* and *G. mandibularis* occur together in Yorkshire, and appear to overlap in much of their continental ranges, they must be regarded as distinct species rather than subspecies as suggested by Valle (1953).

Genus ***DISSOLONCHA*** Falconer

Dissoloncha Falconer, 1923. *Naturalist, Hull* 1923: 151.

TYPE SPECIES. *Macrocheles superbus* Hull, 1918.

The dorsal shield has 28 pairs of setae which are mainly pilose distally; it has a distinct border and crenulate lateral margins. The ventral setae are all pilose distally with the exception of the paranals. The sternal and genital shields are similar to those of *Macrocheles*, but have distinctive patterns. The ventrianal shield has three pairs of preanal setae and bears the inguinal pores (Athias, 1969) in the anterolateral corners. There may be up to three pairs of muscle apodomes between the ventrianal and genital shields, usually two pairs of these adjoin the ventrianal shield. Males have separate sternogenital and ventrianal shields. The gnathotectum tapers into an elongate median process, dentate laterally and bifurcate distally. The female chelae are elongate and basically bidentate; the male chelae are shorter, the fixed chela has four to five teeth and the movable chela is unidentate, the spermatodactyl is short, blunt and dorsally directed. The corniculi are elongate, more than three times as long as broad at the base and the external hypostomal setae are anterior to the internals. The males have major spurs on legs II and IV. The spermathecal sacculus is large, spherical and strongly convoluted, its diameter is greater than the distance between coxae IV.

The most distinctive features of *Dissoloncha* are the shape of the gnathotectum, the elongate corniculi and the more distally placed external hypostomal setae, characters which are all shared with *Geholaspis* s. lat. The placement of the inguinal pores on the anterior lateral corners of the ventrianal shield, a feature also found in *Geholaspis*, is not simply a reflection of the lateral expansion of the ventrianal shield as species of *Macrocheles* in which the shield is strongly expanded still have the inguinal pores free on the membrane. The structure of the sacculus is unique within the Macrochelidae, as is the habitat of rotting seaweed and tidal wrack.

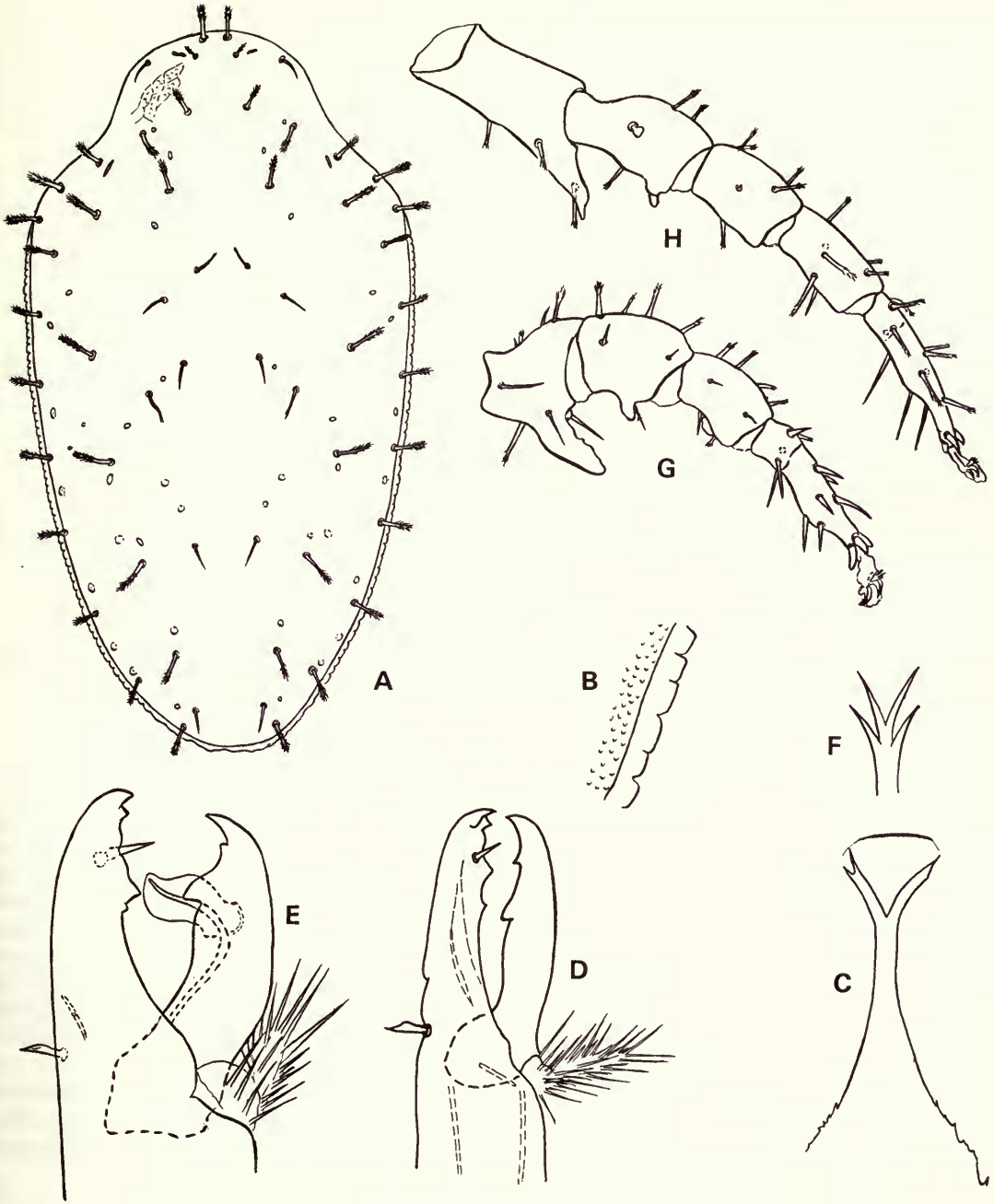


Fig. 6 *Dissoloncha superbus* (Hull): **female**—A dorsal shield; B lateral margin of dorsal shield; C gnathotectum; D chelicera: **male**—E chelicera; F distal end of gnathotectum; G leg II; H leg IV. After Evans & Browning (1956).

Dissoloncha superbus (Hull)
(Fig. 6A–H, Pl. 3D)

Macrocheles superbus Hull, 1918. *Trans. nat. Hist. Soc. Northumb.* **5,** 1: 71.
Dissoloncha superbus: Falconer, 1923. *Naturalist, Hull* 1923: 151.
Macrocheles superbus: Evans & Browning, 1956. *Bull. Br. Mus. nat. Hist.* (Zool.) **4**: 38.

The description of this species given by Evans & Browning (1956) remains adequate.

MATERIAL EXAMINED. 25 collections—3 PNN, approximately 45 DNN, 28 ♂♂ and 200 ♀♀.
ENGLAND: Cornwall, Dorset, Kent, Essex, Yorkshire, Northumberland, Durham.
SCOTLAND: Highland (Inverness-shire), Outer Hebrides (Lewis), Fife, Shetland, Fair Isle, Dumfries & Galloway (Wigtownshire).
WALES: Menai Straits, Milford Haven.

HABITATS. Common in rotting seaweed on beaches, also found in a salt marsh and in rotten grass on a beach. Bregetova & Koroleva (1960) reported it from gulls' nests.

DISTRIBUTION. Probably around the entire coast of the British Isles; also northern Europe, Germany (Krantz, 1972), N. America (Krantz, 1972) and Kuril Islands (Bregetova & Koroleva, 1960). This is quite possibly a holarctic seashore species.

Genus *MACROCHELES* Latreille

Macrocheles Latreille, 1829. In Cuvier, *Règne animalium* 2nd ed. **4**: 282. Type species: *Acarus marginatus* Hermann, 1804 = *Acarus muscae domesticae* Scopoli, 1772.
Coprholaspis Berlese, 1918. *Redia* **13**: 146. Type species: *Holostaspis glabra* Müller, 1860.
Nothrholaspis Berlese, 1918. *Redia* **13**: 169. Type species: *Holostaspis tridentinus* G. & R. Canestrini, 1882.
Monoplites Hull, 1925. *Ann. Mag. nat. Hist.* (9) **15**: 215. Type species: *Macrocheles (Monoplites) oudemansii* Hull, 1925 = *Macrocheles marginatus* Oudemans, 1901 *nec* Hermann, 1804.
Macrholaspis Oudemans, 1931. *Ent. Ber.* **8** No. 180: 272. Type species: *Gamasus opacus* C. L. Koch, 1839.
Andrholaspis Turk, 1948. *Proc. zool. Soc. Lond.* **118**: 103. Type species: *Andrholaspis trinitatus* Turk, 1948.

The dorsal shield has 28–30 pairs of setae and smooth or dentate lateral margins; the dorsum lacks an anterior extension bearing setae *j1*. The sternal shield does not extend posteriorly beyond the middle of coxae III. The metasternal platelets are free, usually small, rounded and bear the metasternal setae. The ventrianal shield has 0–3 pairs of preanal setae, depending on the extent to which it is reduced. If it is reduced there are 1–3 pairs of platelets (muscle apodemes) between it and the genital shield. The peritrematic shield is not fused to the expodal shields. The males either have holoventral shields or separate sternogenital and ventrianal shields. The gnathotectum is usually tripartite, the lateral processes may be free, fused basally or strongly reduced. The chelicerae are strong, the dentition is variable, the cheliceral brushes are shorter than the movable digit, the dorsal seta may be simple, spatulate or pectinate. The leg chaetotaxy is normal for the family (except *M. subbadius* Berlese which has seta pl_1 present on genua IV). The legs of the females are without spurs, the males have spurs on leg II and often on leg IV.

The main change to the definition of Evans & Browning (1956) has been its widening to include species formerly placed in *Macrholaspis* Oudemans (Krantz, 1962) following the realisation that there are species closely related to *M. opacus* (C. L. Koch), its type, with three pairs of preanal ventrianal setae.

Ecological and morphological grouping of the species of *Macrocheles*

The species of the genus *Macrocheles* fall into two broad categories on ecological grounds which correlate with certain morphological features. There are those species that are usually found in leaf litter, moss, nests of birds and small mammals and other habitats not predominantly associated with coprophilic insects, and there are those species that are usually coprophilic, but also found in compost heaps, rotting grass clippings, carrion and similar habitats, generally favoured as breeding grounds by synanthropic muscoid flies.

Species of the latter grouping are often found phoretic, as females, on coprophilic and necrophilic insects, for instance dung beetles, burying beetles and synanthropic flies. Males of these species are rarely found, but when they are, they are usually strongly dimorphic in the shape of the dorsal shield and in the number of pilose dorsal setae, which tends to increase. Well developed spurs are usually found on legs IV of the males of this group as well as on legs II. In the European fauna species of this group tend to have a preponderance of simple setae that are only faintly pilose, but this feature is not constant, particularly in the tropical macrochelid fauna.

Species of the former grouping are generally not phoretic on coprophilic insects, and in some, males are commonly found. The males are not strongly dimorphic, although smaller and with a more tapered dorsal shield. The number of pilose setae remains approximately the same in the males. Well developed spurs are usually only found on legs II although there may be minor tubercles and ridges on legs IV. There tends to be a greater number of strongly pilose setae than in the former grouping.

A few species combine the characters of both these categories, *M. penicilliger* is found phoretic on insects, is not strongly dimorphic and has well-developed spurs on legs IV of the male. *M. matrius* is very often associated with chicken manure and compost heaps, but is not usually phoretic on coprophilic insects; it is not strongly dimorphic but has well developed spurs on legs IV of the male. Both these species have a preponderance of strongly pilose setae.

The species of *Macrocheles* found in the British Isles may therefore be grouped as follows:

Leaf-litter species	**Coprophilic species**
M. decoloratus	*M. muscaedomesticae*
M. punctoscutatus	*M. robustulus*
M. rotundiscutis	*glaber* species group
carinatus species group	*subbadius* species group
opacus species group	

Intermediate species

M. matrius
M. penicilliger

It is interesting to note that Krantz (1981) has shown that the *glaber* species group, the *subbadius* species group, and *M. robustulus*, share characters of the ambulacra in the immature stages not found in other species of *Macrocheles*, and that *M. penicilliger* is intermediate between the two main types of ambulacral structures.

Most of the coprophilic species have been shown to be specialised predators on eggs and young larvae of muscid flies and also on the nematodes and small enchytraeid worms found in their habitat. The leaf-litter group are more likely to be general predators on small anthropods and other animals in their habitat, although biological data are much more fragmentary for these species.

The coprophilic way of life and the characters associated with it are probably derived from the more generalised leaf-litter species. This is supported by comparison with the genus *Geholaspis* which is all litter dwelling and is the most plesiomorphic group of macrochelids. However, males are very rare or unknown in most species of the genus *Geholaspis* and in the *opacus* species group which makes it difficult to draw positive conclusions about their relationships.

Key to the females of the species of *Macrocheles* occurring in the British Isles

1 All setae on dorsal shield simple, needle-like, setae *j1* short, spine-like; sternal shield with *lineae oblique anteriores* joined by four or five transverse lines, the most posterior of which is the *linea media transversa* (Pl. 1F) . . . . . ***subbadius*** species group 2

– Some dorsal setae, always including *j1*, pilose, at least distally; sternal shield variously ornamented, sometimes without regular lines and never as above 4

2 Sternal shield with *lineae oblique anteriores* connected by five lines (Pl. 2A), *linea media transversa* straight or slightly curved posteriorly; genu IV with six or seven setae. 3

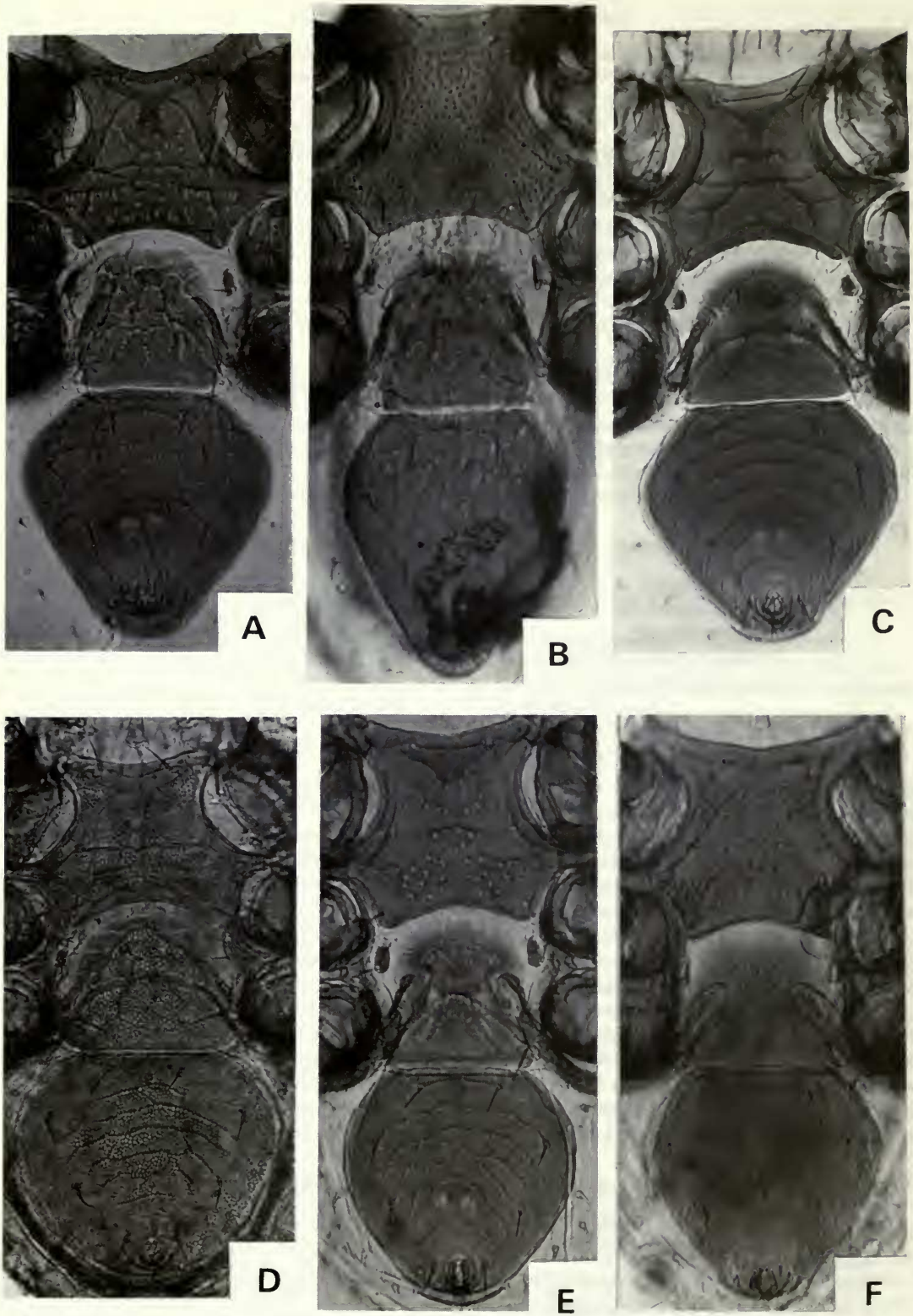


Plate 1 Sternal, genital and ventrianal shields of the females of: A *Macrocheles muscaedomesticae* (Scopoli); B *M. robustulus* (Berlese); C *M. glaber* (Müller); D *M. punctoscutatus* Evans & Browning; E *M. scutatus* (Berlese); F *M. insignitus* Berlese. After Evans & Browning (1956).

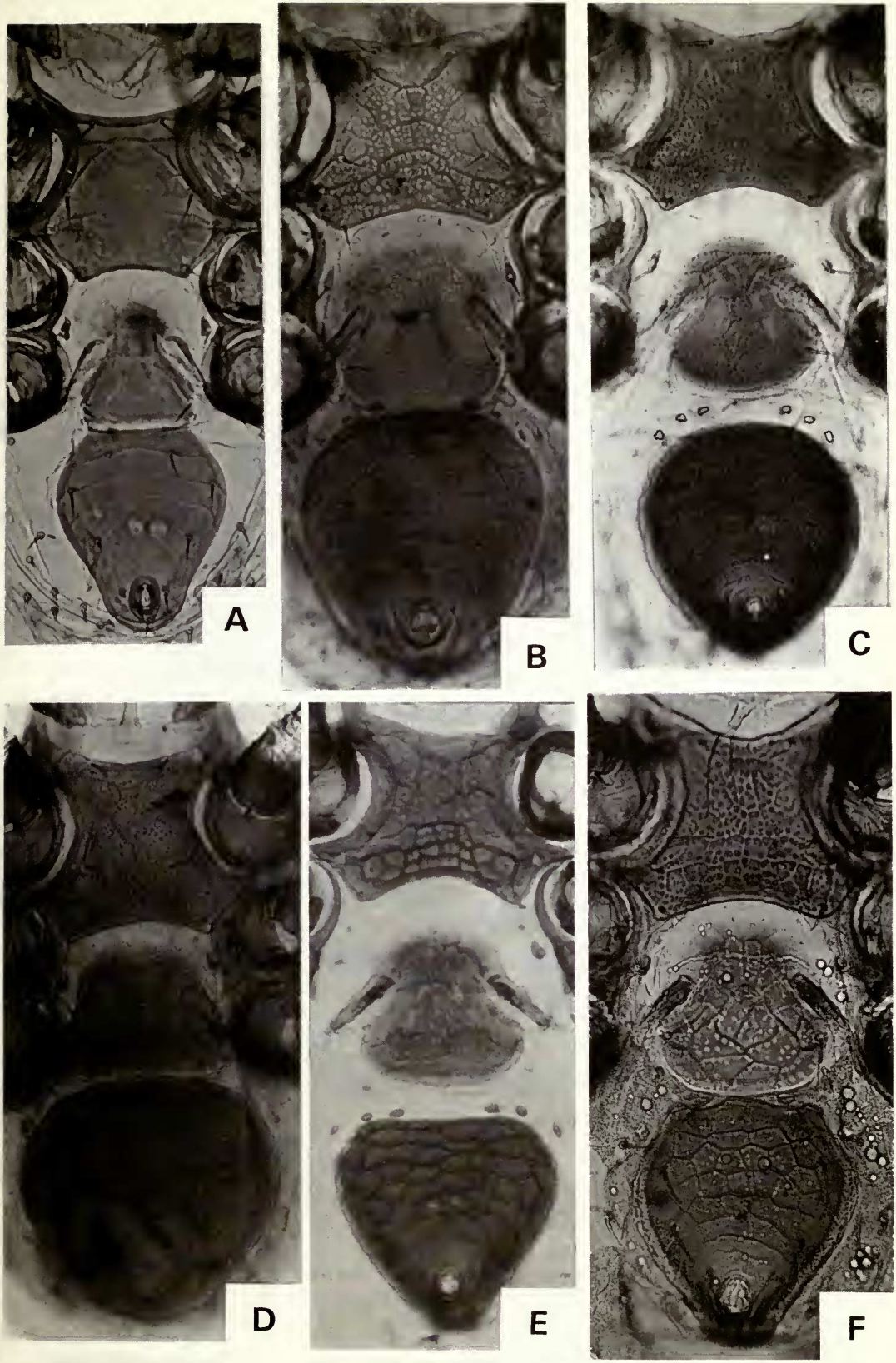


Plate 2 Sternal, genital and ventrianal shields of the females of: A *Macrocheles merdarius* (Berlese); B *M. montanus* (Willmann); C *M. carinatus* (C. L. Koch); D *M. penicilliger* (Berlese); E *M. submotus* Falconer; F *M. tardus* (C. L. Koch). After Evans & Browning (1956).

– Sternal shield with *lineae oblique anteriores* connected by four lines (Pl. 1F), *linea media transversa* arched forwards, all sternal shield lines with a strong edging of punctures; genu IV with six setae, pl_1 absent . . . . . ***M. insignitus*** Berlese (p. 113)

3 All lines of the sternal shield with a strong edging of punctures (Pl. 6E); reticulations of dorsal shield densely covered with minute punctures (Fig. 19A); genu IV with seven setae, pl_1 present . . . . . ***M. subbadius*** (Berlese) (p. 110)

– Transverse lines of sternal shield poorly marked and punctured (Pl. 2A); dorsal shield reticulations more or less unmarked with punctures; genu IV with six setae, pl_1 absent . . . . . ***M. merdarius*** (Berlese) (p. 113)

4 With 1–3 pairs of postgenital platelets or apodemes; ventrianal shield sometimes reduced in size, sometimes with less than three pairs of preanal setae (Pl. 4B) 5

– Without separate postgenital platelets, muscle attachments on ventrianal shield; ventrianal shield of normal size, always with three pairs of preanal setae 12

5 All dorsal setae strongly pilose throughout their entire length, setae *J3* always present, either with *J2* also present or with unpaired setae between *j6* and *J3*; ventrianal shield with two or three pairs of setae, or reduced to an anal shield (Pl. 4B); lateral elements of gnathotectum free (Fig. 12D), reduced in size or absent (Fig. 13D) . . . . . ***opacus*** species group (*partim*) 6

– Some dorsal setae, including *j6, z5, z6, J2* and *J5*, simple, others only pilose in their distal half or two thirds, setae *J3* absent (except *M. montanus* (Willmann)); ventrianal shield always with three pairs of preanal setae; lateral elements of gnathotectum fused basally (Fig. 11B) . . . . . ***carinatus*** species group 9

6 Opisthogastric sclerotisation reduced to an anal shield, without preanal setae (Fig. 13B); lateral elements of gnathotectum absent, with single median process bifurcate distally (Fig. 13D) . . . . . ***M. analis*** sp. nov. (p. 96)

– Opisthogaster with a ventrianal shield with two or three pairs of preanal setae; gnathotectum with reduced lateral elements present (Fig. 12D) 7

7 Ventrianal shield with two pairs of preanal setae 8

– Ventrianal shield with three pairs of preanal setae ***M. terreus*** (Canestrini & Fanzago) (p. 103)

8 Anterior portion of dorsal shield with a network of minute spicules (Fig. 12B), lateral margins with small rounded serrations (Fig. 12C), with a pair of setae in the *J2* position (Fig. 12A) . . . . . ***M. opacus*** (C. L. Koch) (p. 96)

– Anterior portion of dorsal shield without spicules (Fig. 14B), lateral margins with sharp pointed serrations (Fig. 14C), with three or four unpaired median setae between *j6* and *J3* (Fig. 14A) . . . . . ***M. dentatus*** (Evans & Browning) (p. 101)

9 Dorsal setae *z1* smooth, nearly as long as or longer than setae *j1*, and always extending beyond the bases of setae *j2* (Fig. 11A, E) 10

– Dorsal setae *z1* smooth or pilose, much shorter than setae *j1* and never reaching the bases of setae *j2* (Fig. 10A, E) 11

10 Dorsal shield never with more than six pairs of smooth setae (*j6, z1, z5, z6, J2, J5*), setae *j5* as long as setae *j4* and lightly pilose . . . . . ***M. tardus*** (C. L. Koch) (p. 94)

— Dorsal shield with more than six pairs of smooth setae, setae *j2, j5, s2, r3, r4* in addition also smooth (Fig. 11A) . . . . . ***M. submotus*** Falconer (p. 92)

11 Dorsal shield with 29 pairs of setae, *J3* present (Fig. 10E) . ***M. montanus*** (Willmann) (p. 92)

— Dorsal shield with 28 pairs of setae, *J3* absent, setae *j5* shorter than setae *j4* . . . . . ***M. carinatus*** (C. L. Koch) (p. 90)

12 Some dorsal setae, at least a group in the middle of the dorsal shield, including setae *j6, z5, z6* and *J2*, simple needle-like, not pilose (Fig. 9) 13

— All dorsal setae pilose (Fig. 14A) 20

13 Most setae on the dorsal shield simple, setae *s6, S1* and *S2* and usually others on the shield margin simple 14

— All setae on the dorsal shield margins, including all the *s-S* series, pilose (Fig. 15C). 19

14 Dorsal setae generally long, curved or wavy, setae *Z4* reaching beyond bases of setae *J5*, setae *j4, z2, z4, s2, r2, r3* pilose (Fig. 9); ventrianal shield subcircular, slightly truncate anteriorly, ornamented with lines and punctures . ***M. rotundiscutis*** Bregetova & Koroleva (p. 88)

— Dorsal setae generally short, straight or slightly curved; distal ends of setae *Z4* fall well short of bases of setae *J5* (Fig. 16A); ventrianal shield usually pentagonal, truncate anteriorly (Pl. 1B), if strongly rounded then densely covered with minute punctations (Pl. 1D) and with only setae *j1* and *r3* pilose on anterior part of dorsal shield (Fig. 8G) 15

15 Setae *j1* elongate, over twice as long as setae *j2* and noticeably longer than setae *j3*, minutely pilose

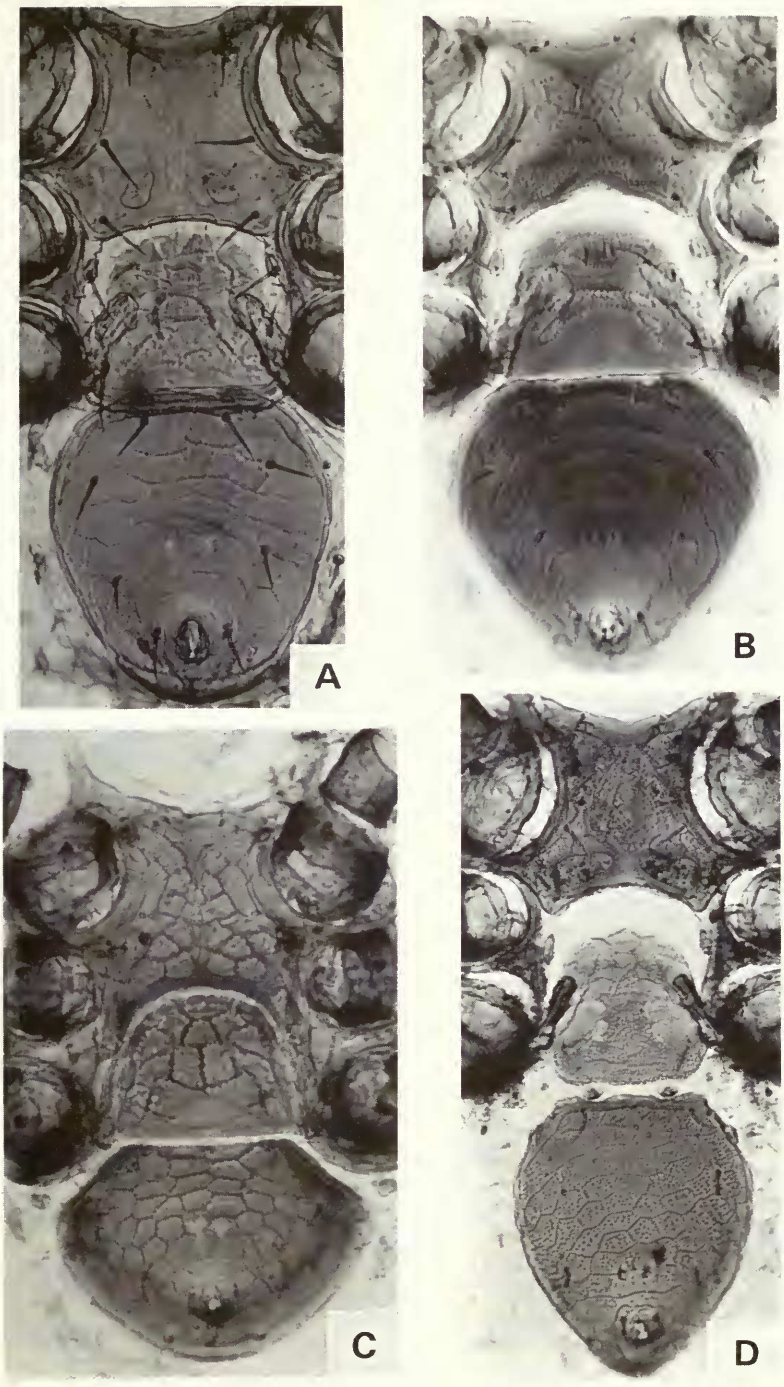


Plate 3 Sternal, genital and ventrianal shields of the females of: A *Macrocheles decoloratus* (C. L. Koch); B *M. matrius* (Hull); C *Glyptholaspis confusa* (Foà); D *Dissoloncha superbus* (Hull). After Evans & Browning (1956).

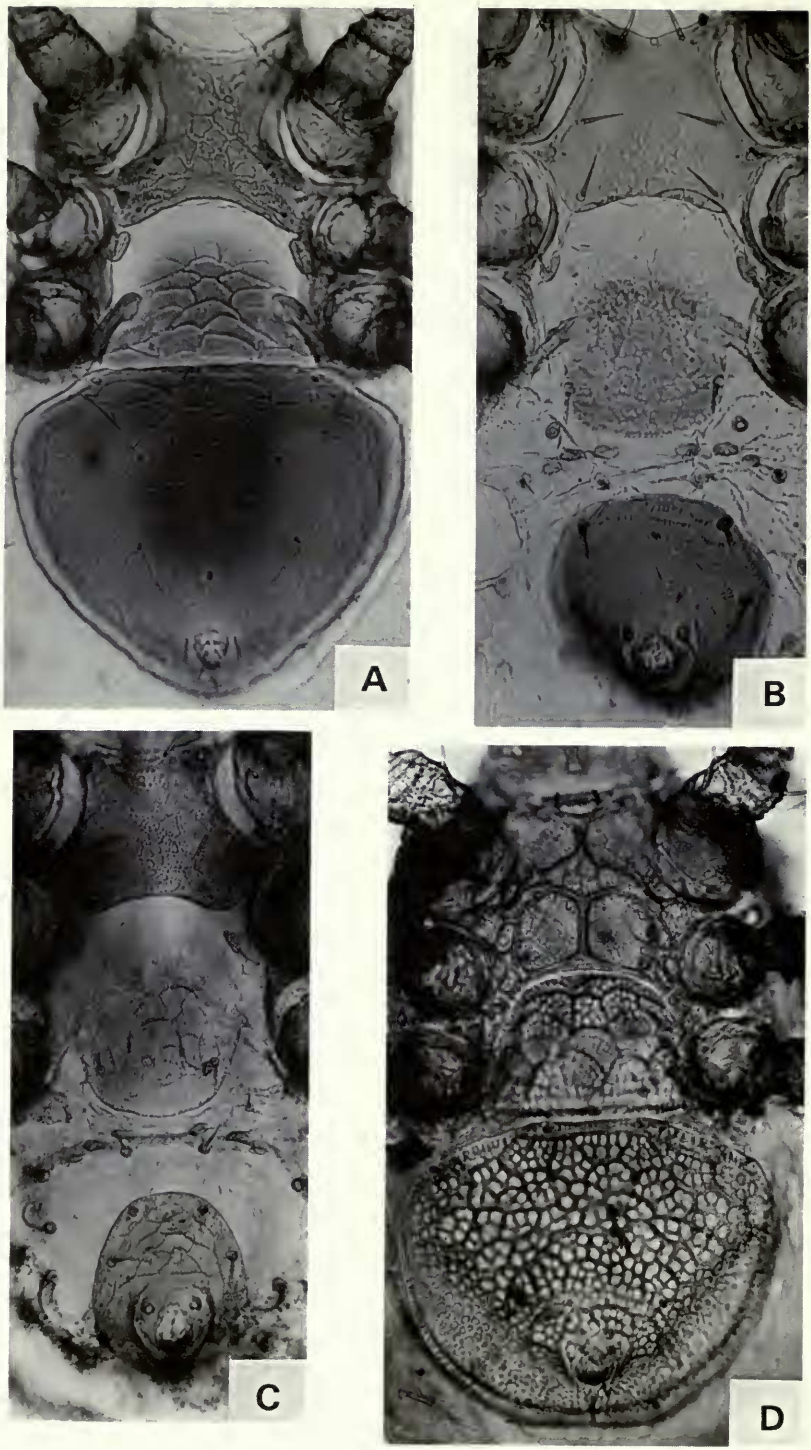


Plate 4 Sternal, genital and ventrianal shields of the females of: A *Geholaspis (G.) longispinosus* (Kramer); B *Macrocheles opacus* (C. L. Koch); C *M. dentatus* Evans & Browning; D *Holostaspella ornata* (Berlese). After Evans & Browning (1956).

distally (Fig. 16B), setae *J5* simple, about half as long as setae *Z5* (Fig. 16A); sternal shield without distinct lines but with a more or less symmetrical pattern of punctures some of which may be linearly arranged (Pl. 1B) . . . . . ***M. robustulus*** (Berlese) (p. 106)

— Setae *j1* short and stout, little longer than setae *j2* and *j3*, distinctly pilose in distal third to half, setae *J5* simple or pilose, as long as or little shorter than setae *Z5* (Fig. 8D); sternal shield with a distinct pattern of lines (Pl. 1D) 16

16 All sclerotised regions densely covered with minute punctations (Fig. 8D); ventrianal shield strongly rounded, almost subcircular in outline (Pl. 1D).
. . . . . ***M. punctoscutatus*** Evans & Browning (p. 88)

— Sclerotised regions not densely punctate as above; ventrianal shield pentagonal in outline (Pl. 1C)
. . . . . ***glaber*** species group 17

17 Posterior series of dorsal setae with five pairs (*J5, Z4, Z5, S4, S5*) of setae on the dorsal shield pilose, at least distally (Fig. 17E); sternal shield with *linea arcuata* faintly impressed impunctate, all sternal shield punctures minute (Pl. 6D) . . ***M. nataliae*** Bregetova & Koroleva (p. 109)

— Posterior series of dorsal setae with only one pair of pilose setae (*J5*) on the dorsal shield (Fig. 17A); sternal shield with several well developed punctures along *linea arcuata* (Pl. 1C), sternal shield punctures of different sizes, some minute, some larger 18

18 *Linea arcuata* on sternal shield more or less straight but having its ends directed posteriorly, all lines on sternal shield well developed, not strongly punctured (Pl. 1C)
. . . . . ***M. glaber*** (Müller) (p. 107)

— *Linea arcuata* strongly concave, having its ends directed anteriorly, lines on sternal shield not strongly impressed, punctures well developed (Pl. 1E) . ***M. scutatus*** (Berlese) (p. 110)

19 Dorsal setae only pilose in their distal third; setae *J5* pilose (Fig. 15C); lateral elements of gnathotectum free (Fig. 15D) . . . . . ***M. muscaedomesticae*** (Scopoli) (p. 105)

— Dorsal setae pilose in their distal half to two thirds, setae *J5* simple (Fig. 7C); lateral elements of gnathotectum fused basally (Fig. 7D) . . . . . ***M. penicilliger*** (Berlese) (p. 86)

20 Dorsal setae pilose along their entire length, with an extra unpaired median seta present in the *J2* position between *j6* and *J3* (Fig. 14E); sternal shield densely covered with punctures (Pl. 6B)
. . . . . ***M. punctatissimus*** Berlese (***opacus*** species group) (p. 101)

— Dorsal setae only pilose in their distal halves, setae *J2* paired, setae *J3* absent, i.e. with 28 pairs of setae (Fig. 8A); sternal shield with a pattern of lines and small areas of punctures (Pl. 3A) . . 21

21 Setae *J5* approximately equal in length to setae *Z5* and little more than half as long as setae *S5* (Fig. 8A); outer margins of lateral elements of gnathotectum smooth (Fig. 8B)
. . . . . ***M. decoloratus*** (C. L. Koch) (p. 88)

— Setae *J5* shorter than setae *Z5*, setae *Z5* approximately equal in length to setae *S5* (Fig. 7A); outer margins of lateral elements of gnathotectum serrated (Fig. 7B) . ***M. matrius*** (Hull) (p. 85)

Macrocheles matrius (Hull)
(Fig. 7A, B, Pl. 3B)

The description of Evans & Browning (1956) requires no amendment.

TYPE MATERIAL. **Lectotype** ♀ 'n.v.' [? Ninebanks vicarage, Northumberland]. poultry manure, Hull collection. Here designated. **Paralectotypes** 18 ♀♀, same data as lectotype [BMNH].

MATERIAL EXAMINED. 11 collections—4 ♂♂, 194 ♀♀.

ENGLAND: Gloucestershire, Surrey, Cambridgeshire (Huntingdonshire), Worcestershire, Staffordshire, Derbyshire, Northumberland.

SCOTLAND: Grampian (Aberdeenshire), Inner Hebrides (Pabay).

HABITATS. Four collections associated with poultry, also with mink *Mustela vison*, water shrews *Neomys fodiens*, in a canary cage and from grass clippings and compost.

DISTRIBUTION. Widespread in Europe; Germany (Krantz, 1972), Austria (Johnston, 1970), Bulgaria (Balogh, 1958), U.S.S.R. (Bregetova & Koroleva, 1960). Also known from the U.S.A. (Axtell, 1963), Israel (Costa, 1966*b*) and New Zealand (Emberson, 1973*a*).

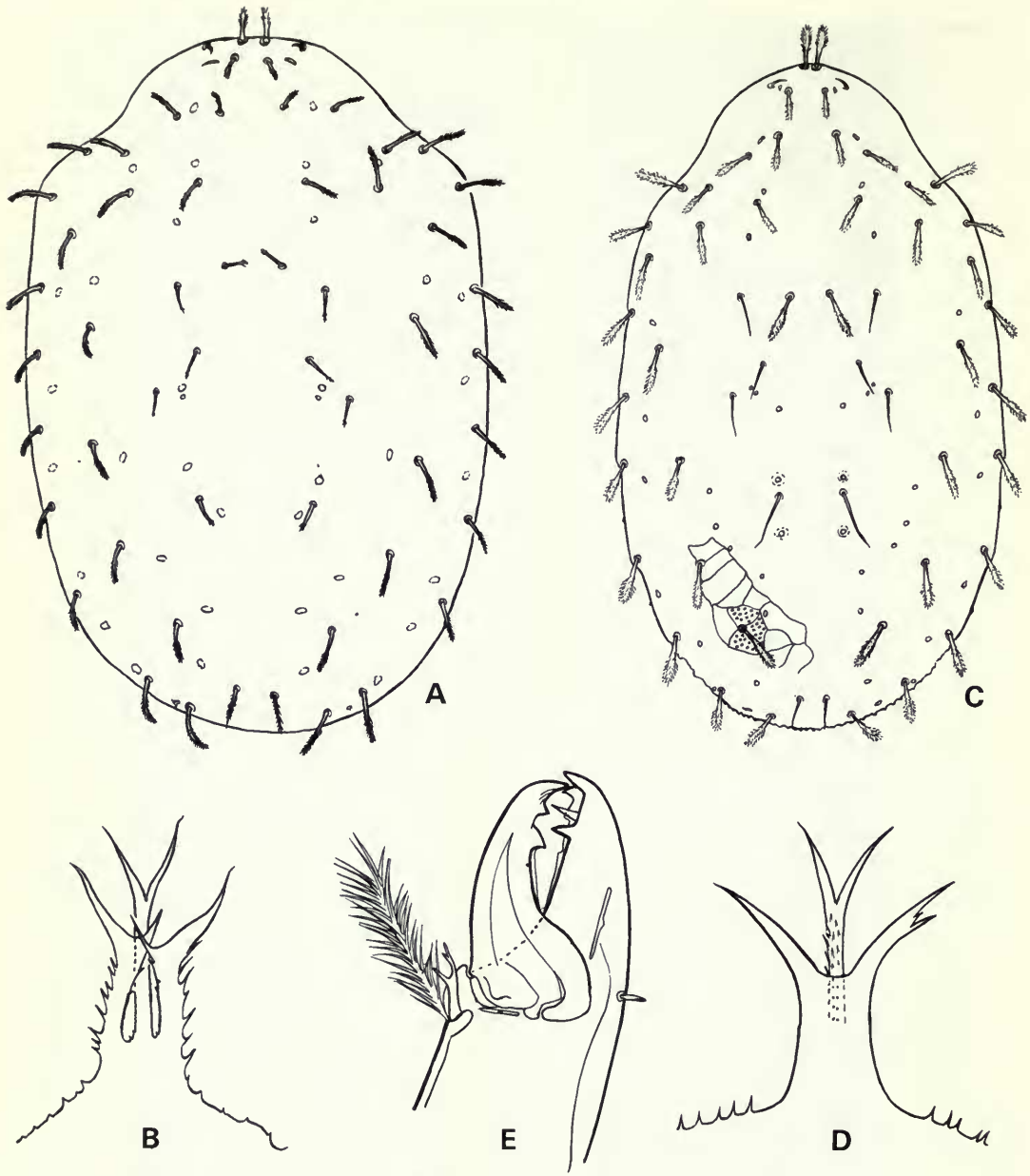


Fig. 7 *Macrocheles matrius* (Hull): **female**—A dorsal shield; B gnathotectum. *Macrocheles penicilliger* (Berlese): **female**—C dorsal shield; D gnathotectum; E chelicera. After Evans & Browning (1956).

Macrocheles penicilliger (Berlese)
(Fig. 7C–E, Pl. 2D)

The description of Evans & Browning (1956) requires no amendment.

TYPE MATERIAL. **Syntypes** 2 ♀♀ only, Italy, Cison di Valmarino, Treviso, sotto legni [under wood] slide 3/38 [ISZA].

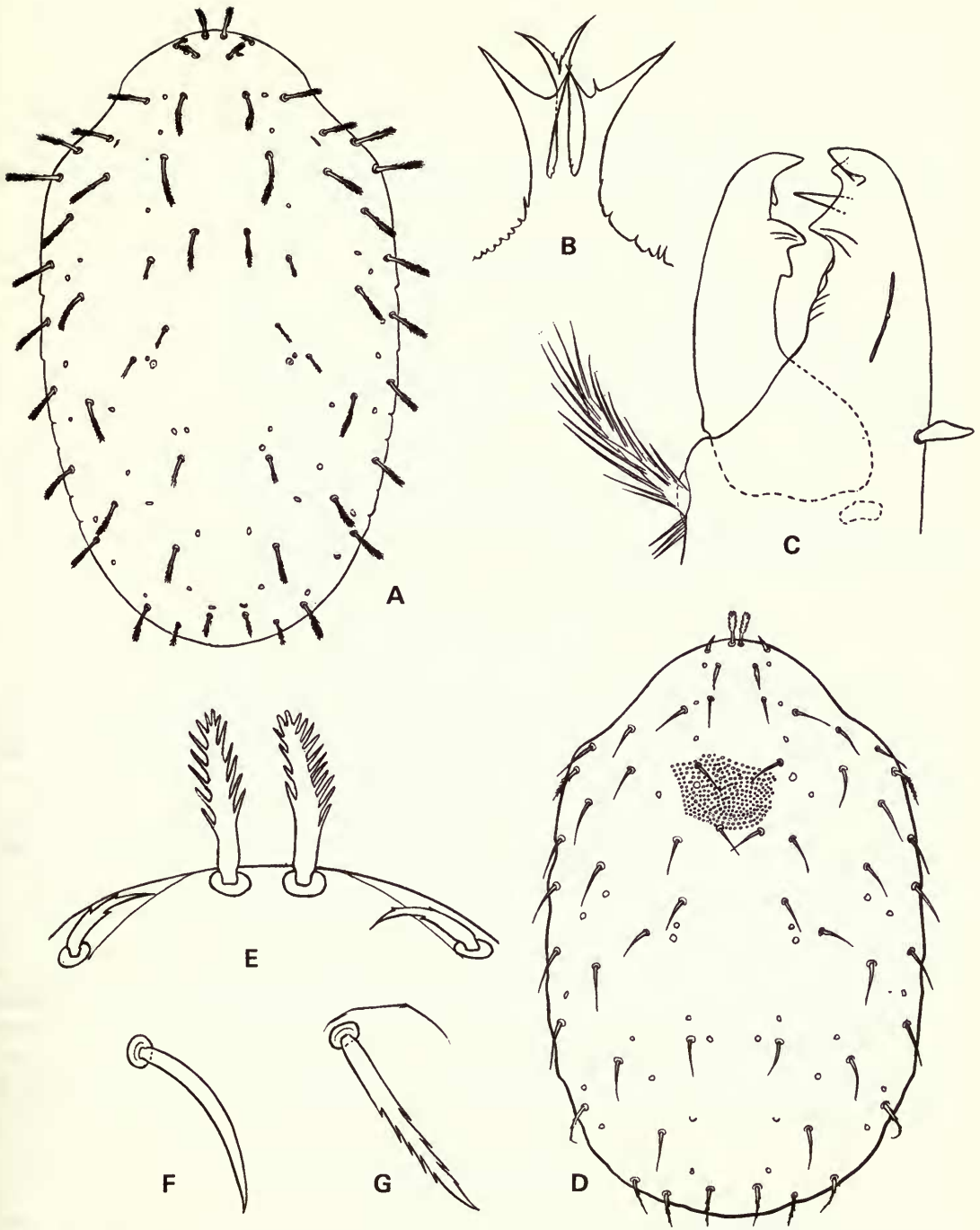


Fig. 8 *Macrocheles decoloratus* (C. L. Koch): **female**—A dorsal shield; B gnathotectum; C chelicera. *Macrocheles punctoscutatus* Evans & Browning: **female**—D dorsal shield; E anterior margin of dorsal shield; F seta *s2*; G seta *r3*. After Evans & Browning (1956).

MATERIAL EXAMINED. 13 collections—3 DNN, 1 ♂, 125 ♀♀.
ENGLAND: Cornwall, Surrey, Kent, London, Middlesex, Essex, Bucks, Oxfordshire, Cheshire.
WALES: Gwynedd (Caernarvonshire).
IRELAND: Clare.
CHANNEL ISLANDS: Jersey.

HABITATS. Three collections associated with *Trox scaber* (L.), also found in insect cultures, decaying leaves, compost and sewage culture.

DISTRIBUTION. Apparently widespread in Europe; Germany (Karg, 1970), U.S.S.R. (Bregetova & Koroleva, 1960), also known from New Zealand (Emberson, 1973*a*).

Macrocheles decoloratus (C. L. Koch)
(Fig. 8A–C, Pl. 3A)

Evans & Browning's (1956) description and synonymy remain unchanged

MATERIAL EXAMINED. 8 collections—1 ♂, 60 ♀♀.
ENGLAND: Gloucestershire, Kent.
SCOTLAND: Tayside (Perthshire), Fife, Highland (Inverness-shire).
IRELAND: Cork.

HABITATS. Six out of eight collections are from sand martin *Riparia riparia* nests, also collected from cow dung and moss and known from small mammal nests in U.S.S.R.

DISTRIBUTION. Widespread in the British Isles and Europe; Germany (Karg, 1970), U.S.S.R., (Bregetova & Koroleva, 1960).

Macrocheles punctoscutatus Evans & Browning
(Fig. 8D–G, Pl. 1D)

Macrocheles punctoscutatus Evans & Browning, 1956. *Bull. Br. Mus. nat. Hist.* (Zool.) **4**: 18.

The description of this species remains adequate. Bregetova & Koroleva (1960) have published a description of a male reputed to be this species. It appears to be very different from the female having only setae *J5* on the dorsal shield pilose, also the complete covering of fine punctures appears to be lacking. The male has a holoventral shield, leg II is armed with a strong spur on the femur, small tubercles are present on other segments and on leg IV.

TYPE MATERIAL. **Holotype** ♀, England, Glos., Churcham, from nest of mole *Talpa europaea*, 16.v.1954. R. S. George. [BMNH].

MATERIAL EXAMINED. 4 collections—12 ♀♀.
ENGLAND: Gloucestershire, Wiltshire, Oxfordshire.
SCOTLAND: Inner Hebrides (Eigg).

HABITATS. Associated with small mammals; three collections from nests of moles *Talpa europaea*, one collection from *Microtus agrestis*. Bregetova & Koroleva (1960) record this species from a variety of small mammals.

DISTRIBUTION. Probably throughout the British Isles. Widespread in U.S.S.R. (Bregetova & Koroleva, 1960), Germany (Karg, 1970).

Macrocheles rotundiscutis Bregetova & Koroleva
(Fig. 9, Pl. 6A)

Macrocheles rotundiscutis Bregetova & Koroleva, 1960. *Parazit. Sb.* **19**: 116.
Macrocheles bombophilus Götz, in Krauss, 1970. *Acarologie* **14**: 28, **Syn. nov.**

FEMALE. The dorsal shield has 28 pairs of setae, most of which are long and curved or slightly wavy (Fig. 9). Setae *j1* are short, broad and pilose; eight pairs of setae (*j4, z2, z4, s2, r2, J5, Z5, S5*) are long and strongly pilose over most of their length, setae *r3* are faintly pilose and the other setae are simple. The setae on the dorsal shield are much longer than those off the shield. The dorsal shield

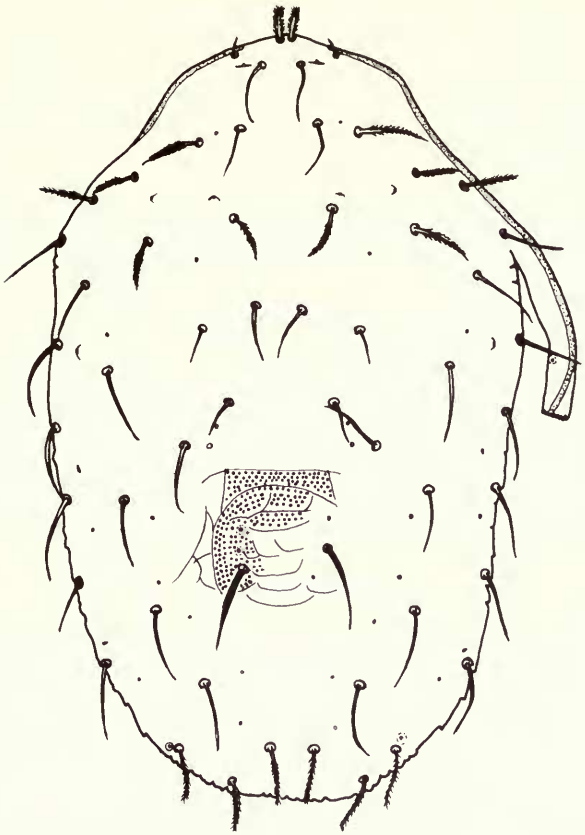


Fig. 9 *Macrocheles rotundiscutis* Bregetova & Koroleva: **female**—dorsal shield.

is ornamented with reticulations and fine dense punctation, the lateral margins are irregularly serrate.

With the exception of the postanal setae, the setae on the ventral shields are simple. The sternal shield has a characteristic reticulate pattern (Pl. 6A) of ridges and punctures within the reticulations. The metasternal plates are rounded ovate. The genital shield is well marked with fine ridges and punctures. The ventrianal shield is broader than long and subcircular in outline, truncate anteriorly and only slightly angled laterally. The ornamentation is characteristic, consisting of curved transverse lines with a broad band of punctuation along the posterior edge of each line, and the punctures in each band decreasing in size posteriorly. The spermathecal apparatus has the normal two-lobed sacculus with the lobes widely separated, the corniculum is small and narrow.

The gnathotectum has free lateral processes, the bifurcate median process is spiculate basally. The fixed chela is bidentate and the movable chela tridentate. The cheliceral dorsal seta is simple or faintly serrate distally.

The setae on coxae III and IV are pilose; those on coxa, tibia and tarsus I are simple; other leg segments have a mixture of pilose and simple setae.

MALE. The male is unknown in the British Isles and was not known to Bregetova & Koroleva (1960). However, Götz (in Krauss, 1970), described the male from Germany (as *M. bombophilus*).

The distribution of pilose dorsal setae is similar to the female. There is a holoventral shield. The fixed chela is bidentate and the movable chela unidentate; the spermatodactyl is about one-and-a-half times the length of the movable chela and has an anteriorly projecting basal tubercle. Leg II is armed with a spur on the femur and leg IV with tubercles and ridges on the trochanter and femur.

TYPE MATERIAL. *M. rotundiscutis*: 10 ♀♀ **syntypes**, Lithuanian S.S.R., Ventes-ragas, litter under leaves in cemetery, 27.vii.1957, Ivanov [ZINL].

The type material of *M. bombophilus* was not available for study, but there can be little doubt of the synonymy based on the description and drawings of Götz (in Krauss, 1970).

MATERIAL EXAMINED. 1 collection—1 ♀.

ENGLAND: Surrey.

HABITAT. A single female in leaf litter at Kew Gardens, Surrey is the first British record. Bregetova & Koroleva (1960) record this species from leaf litter, hay and compost, and Götz (in Krauss, 1970) records it from bumble-bee nests.

DISTRIBUTION. Germany (Götz in Krauss, 1970); U.S.S.R., Leningrad region, Lithuanian S.S.R. and Caucasus (Bregetova & Koroleva, 1960).

REMARKS. There are slight variations between the British specimen and the Lithuanian syntypes, the sternal shield pattern is slightly more complex and the punctate bands on the ventrianal shield wider in the British specimen. Setae *J5* are longer than shown in Bregetova & Koroleva's drawing, both in the British and Lithuanian material examined, almost reaching the posterior margin of the dorsal shield. Also setae *z2* are pilose in all the material examined and are shown in Bregetova & Koroleva's drawing, but said to be simple by Götz.

carinatus group

Krantz (1972) intimated that *M. carinatus* and other similar species formed a species group, although the existence of a group of very similar species was implicitly recognised by Bregetova & Koroleva (1960) and others. The members are medium to large sized (females 1000–1500 μm in length) heavily sclerotized, litter-dwelling species of *Macrocheles*. The dorsal shield has 28–29 pairs of setae, *J3* being present in addition to *J2* in some species. Most of the dorsal setae are pilose in their distal half to two thirds. There is always a group of more or less simple setae in the middle of the dorsal shield that includes *j6, z5, z6, J2* and *J3* if present. In addition other setae, including *j2, j5, z1, s2, r3, r4* and *J5*, are simple in some species. The dorsal shield is generally ornamented with a reticulate pattern and sometimes with a punctate microsculpture. The posterior and lateral margins may be irregularly crenulate or smooth. The setae on the ventral shields may be simple or pilose. The sternal shield pattern consists of a reticulate-punctate network which is more pronounced and more punctate in the posterior third. The metasternal plates are small and oval with both seta and pore. The genital shield is ornamented with a punctate lineal pattern. It is generally rounded posteriorly and the associated pores are free on the membrane. The ventrianal shield is reduced, subtriangular or rounded and has a pattern of punctate lines. There are three pairs of free postepigynal apodemes in the membranous cuticle. Males have separate sternogenital and ventrianal shields. The gnathotectum has the lateral processes fused and the stem of the median process strongly spiculate. The dentition of the chelae varies from species to species, but the spermatodactyl is short, about half the length of the movable chela, strongly tapered and directed postero-dorsally; the dorsal seta is pectinate latero-distally. The leg setation is normal for the genus and is a mixture of simple and pilose setae. In the male leg II is armed with a simple spur on the femur and small tubercles on the genu and tibia. The spermathecal structures are indistinct.

INCLUDED SPECIES: *M. carinatus* (C. L. Koch), *M. montanus* (Willmann), *M. submotus* Falconer, *M. tardus* (C. L. Koch).

Macrocheles carinatus (C. L. Koch)
(Fig. 10A–D, Pl. 2C)

The description and synonymy given by Evans & Browning (1956) need no amendment.

MATERIAL EXAMINED. 53 collections—several DNN, 49 ♂♂, 90 ♀♀.

ENGLAND: Isles of Scilly, Cornwall, Somerset, Dorset, Surrey, London, Kent, Hertfordshire, Berkshire, Buckinghamshire, Cambridgeshire, Leicestershire, Nottinghamshire, Yorkshire, Cumbria (Westmorland), Northumberland.

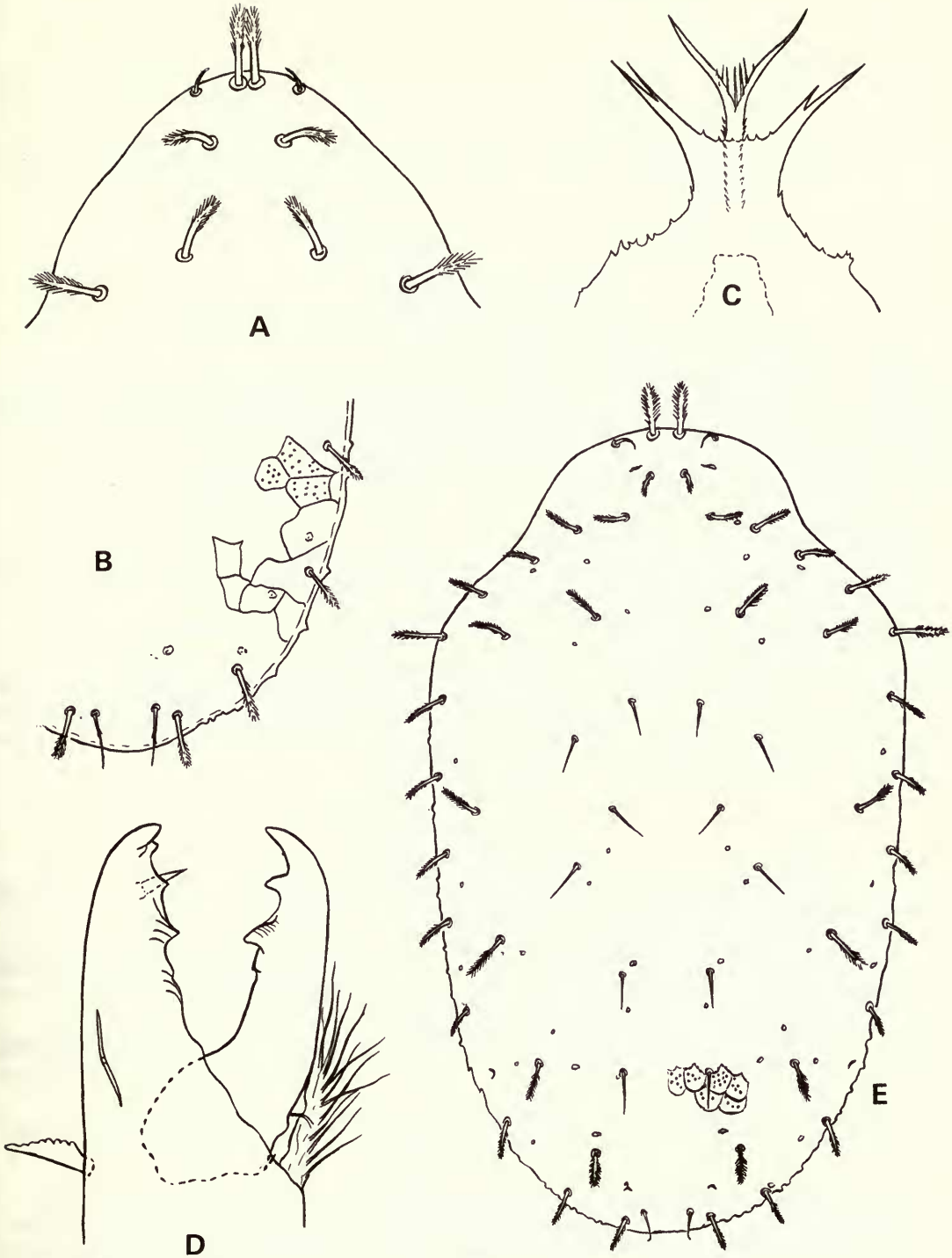


Fig. 10 *Macrocheles carinatus* (C. L. Koch): **female**—A anterior region of dorsal shield; B posterolateral margin of dorsal shield; C gnathotectum; D chelicera. *Macrocheles montanus* (Willmann): **female**—E dorsal shield. After Evans & Browning (1956).

SCOTLAND: Tayside (Perthshire), Inner Hebrides (Mull), Shetland.
WALES: Dyfed (Pembrokeshire), Glamorgan, Gwent, Gwynedd (Caernarvonshire).
IRELAND: Clare, Westmeath, Leitrim.

HABITATS. A variety of litter habitats including flood debris, dead grass, seaweed, moss, etc., also from *Microtus agrestis*. Probably mainly found in damp places.

DISTRIBUTION. Throughout the British Isles, widespread in Europe, recent records include: U.S.S.R. (Bregetova & Koroleva, 1960), Germany (Krantz, 1972), Austria (Johnston, 1970), Bulgaria (Balogh, 1958).

Macrocheles montanus (Willmann)
(Fig. 10E, Pl. 2B)

The description and synonymy given by Evans & Browning (1956) remain unaltered.

MATERIAL EXAMINED. 40 collections—1 ♂, 82 ♀♀.
ENGLAND: Cornwall, Somerset, Dorset, Sussex, Surrey, London, Kent, Hertfordshire, Berkshire, Buckinghamshire, Cambridgeshire (including Huntingdonshire), Northamptonshire, Lancashire, Durham, Northumberland, Cumbria (Cumberland).
SCOTLAND: Tayside (Angus, Perthshire), Inner Hebrides (Mull).
WALES: Gwent.
IRELAND: Westmeath.

HABITATS. Mainly leaf litter, also cow dung and under wet oak bark. Three collections from small mammals (*Sorex araneus* and *Microtus agrestis*).

DISTRIBUTION. Similar to *M. carinatus*, recent records include U.S.S.R. (Bregetova & Koroleva, 1960), and Germany (Krantz, 1972).

REMARKS. A very similar species, also with setae *J3* present, has been described by Bregetova & Koroleva (1960) from the Caucasus region of the U.S.S.R. One of us (R.M.E.), having examined the types of *M. montivagus* Berlese, follows Krantz (1972) in rejecting the synonymy of *M. montanus* with that species as proposed by Krauss (1970).

Macrocheles submotus Falconer
(Fig. 11A–D, Pl. 2E)

The description of this species in Evans & Browning (1956) is satisfactory, except that *j3* (*D3*) and *z2* (*M2*) are usually less pilose than described and figured.

It is evident that Falconer had several collections before him when he described this species as *M. cognatus*, a junior homonym of *M. cognatus* Berlese 1918. He states (Falconer, 1923: 152) 'Found amongst dead leaves, sphagnum and heaps of cut grass in a field at Slaithwaite, *first examples* [our italics] May, 1919'. He also mentions both males and females. No type was designated.

The only material of these collections now known to exist is two females and two males labelled '2nd lot' from the Falconer collection and now housed in the Arachnida collection of the British Museum (Natural History).

TYPE MATERIAL. **Lectotype** ♀, here designated, [England, ? Slaithwaite, Yorkshire] '2nd lot', Falconer coll. [BMNH]. **Paralectotypes**, 1 ♀, 2 ♂♂, same data as lectotype, [BMNH].

MATERIAL EXAMINED. 122 collections—*c.* 26 PNN, 44 DNN, 134 ♂♂, 225 ♀♀.
ENGLAND: Devon, Somerset, Gloucestershire, Dorset, Hampshire, Surrey, Sussex, Kent, London, Essex, Middlesex, Berkshire, Leicestershire, Lancashire, Yorkshire, Durham, Northumberland, Cumbria (Westmorland).
SCOTLAND: Strathclyde (Argyllshire), Tayside (Perthshire), Dumfries & Galloway (Wigtownshire), Highland (Inverness-shire, Ross & Cromarty), Inner Hebrides (Skye, Scalpay, Mull, Ulva), Shetland.

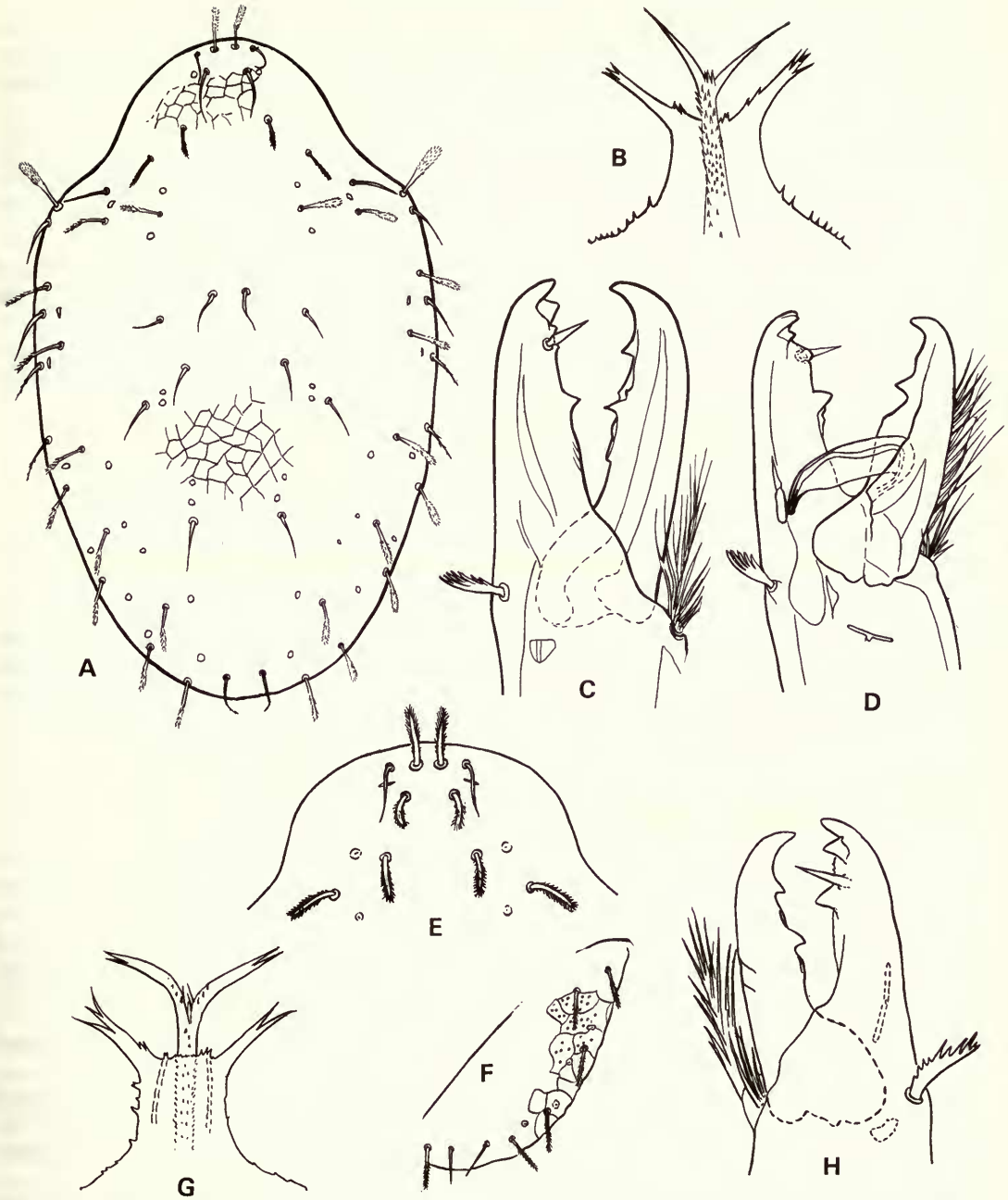


Fig. 11 *Macrocheles submotus* Falconer: **female**—A dorsal shield; B gnathotectum; C chelicera: **male**—D chelicera. *Macrocheles tardus* (C. L. Koch): **female**—E anterior region of dorsal shield; F postero-lateral margin of dorsal shield; G gnathotectum; H chelicera. After Evans & Browning (1956).

WALES: Glamorgan, Gwent, Gwynedd (Merionethshire, Caernarvonshire), Clwyd (Denbighshire).

IRELAND: Clare, Mayo, Galway, Sligo, Leitrim, Westmeath.

CHANNEL ISLANDS: Jersey.

HABITATS. A wide variety of leaf litter habitats, also mosses; some evidence of association with damp habitats, i.e. *Sphagnum*, flood debris, saltwater marsh, etc. Twelve collections from small mammals (*Sorex minutus, S. araneus* and *Microtus agrestis*).

DISTRIBUTION. Common throughout the British Isles. No positive records for this species outside the British Isles are known to the authors. The records by Halbert (1915) of *Holostaspis tridentinus* G. & R. Can. refer to this species, but other records, where it has been possible to check, refer to other species of the *carinatus* group.

REMARKS. As mentioned above, the correct name for this species has been very confused in the European literature. The situation has not been helped by Krauss (1970) who synonymizes *M. submotus* Falconer and *M. tardus, sensu* Evans & Browning, with *M. tridentinus* (G. & R. Canestrini). Whatever decision is made as to the status of *M. tardus* (Koch) the fact remains that *M. submotus* is a very different species from that described and illustrated by Krauss (1970) as *M. tridentinus*.

Macrocheles tardus (C. L. Koch)
(Fig. 11E–H, Pl. 2F)

Gamasus tardus C. L. Koch, 1841. *Deutschlands Crustaceen, Myriapoden und Arachniden*. Regensburg, Heft 39, no. 14.

Holostaspis tridentinus G. & R. Canestrini, 1882. *Atti Soc. ven.-trent. sci.* **8**: 28.

The treatment of this species by Evans & Browning (1956) remains adequate.

TYPE MATERIAL. *M. tridentinus*: **Neotype** ♂, here designated. Labelled as follows: yellow-bordered printed label, Coll. Berlese. *Macrocheles tridentinus* (G. & R. Can.), ♂ Tiarno (Trentino) musco [moss], slide 187/43 [ISZA].

MATERIAL EXAMINED. 18 collections—9 ♂♂, 29 ♀♀.

ENGLAND: Gloucestershire, Cambridgeshire (including Huntingdonshire), Yorkshire, Cumbria (Westmorland).

WALES: Glamorgan.

IRELAND: Leitrim, Westmeath.

HABITAT. A variety of habitats with a tendency towards damp situations, i.e. flood debris, moss, peat and *Molinia* tussocks in the fens.

DISTRIBUTION. A widespread species in the British Isles and Europe. Recent records include: U.S.S.R. (Bregetova & Koroleva, 1960), Germany (Krantz, 1972).

REMARKS. The present authors agree with Krantz (1972) that the name *M. tardus* Koch is best used for this species rather than for species of *Glyptholaspis* as proposed by Krauss (1970).

The identity of *M. tridentinus* has long remained a problem because of the inadequate original description and figures (G. & R. Canestrini, 1882). One of us (R.M.E.) has recently had the opportunity to examine parts of the Canestrini Collection in Padova and hopes that the problem may here be resolved.

The original description was based mainly on a male specimen, and, to a lesser extent, on what the Canestrini brothers referred to as juvenile females. These latter were probably specimens of an unrelated and now entirely unrecognisable species. No types were specifically designated but Trentino was mentioned as the locality from which the material came. In the Canestrini Collection there is a tube (jar no. XX, vial no. 556) labelled *Holostaspis tridentinus* Can., Trentino, which could be taken as containing the type series of *M. tridentinus*. This material was evidently seen by Valle (1955). Unfortunately this tube, together with several others examined, was empty. The

late Dr A. Filipponi also encountered this problem when he examined parts of the Canestrini Collection (Pegazzano, personal communication).

The only other material in the Collection labelled as *H. tridentinus* is a badly damaged, over-cleared, transparent male of *M. carinatus* (jar no. XX, vial no. 604) from an unknown locality.

H. tridentinus appears to be conspecific with either *M. tardus* or *M. carinatus* as understood here and interpreted by Evans & Browning (1956). For reasons given below synonymy with the former species is favoured. *M. submotus* can be almost totally discounted from consideration in spite of its frequent synonymisation with *tridentinus* on the grounds that no authentic material of *M. submotus* is known to exist in central or southern Europe.

In the Berlese collection there are two specimens identified as *M. tridentinus* from Tiarno (Trentino) which can be considered topotypical. They date from Berlese's Padova period (slide labels with yellow borders) and may have been collected when Berlese was a student of G. Canestrini. These specimens are both *M. tardus* as here understood. One of these (187/43) has been selected as a neotype of *M. tridentinus*.

The only discrepancy between the neotype and the original description of *tridentinus* is the length of the body. The following are measurements based on G. & R. Canestrinis' (1882) description, the neotype, and typical values for *M. carinatus* and also ratios of body length to the other values:

		Canestrini *tridentinus*	**neotype** *tridentinus*	**typical values** *carinatus*
Body length	μm	860	1050	870–910
Body width	μm	640 (1 : 0.74)	660 (1 : 0.63)	500–540 (1 : 0.58)
Leg IV length	μm	1250 (1 : 1.45)	1300 (1 : 1.24)	980–1000 (1 : 1.11)

It is apparent that there is good agreement in body width and leg length with the neotype and that these measurements fall outside the normal range for *M. carinatus*. Also the ratios of body length to body width and body length to length of leg IV derived from the Canestrini measurements would be abnormal for this type of mite.

The most likely explanation for these inconsistencies is that there is an error in the body length measurement in the original description, and that the Canestrinis had before them a specimen of *M. tardus*. For these reasons synonymy with *M. tardus* is favoured and a suitable neotype chosen.

opacus group

The *opacus* species group was distinguished by Johnston (1970) for a characteristic group of litter- and soil-dwelling *Macrocheles*. The dorsal shield has a basic complement of twenty-eight pairs of setae plus an additional one to four setae that may be paired or unpaired. Setae *J3* are always present (absent in most other *Macrocheles*) and between setae *j6* and *J3* there may be a single seta, a pair of setae or three or four unpaired setae. Setae *j1* are short and laterally expanded, other setae are usually long, tapered and pilose along their entire length; setae *z1* and *J5* may be considerably shorter than the others. The dorsal shield usually tapers from the shoulders and often does not cover the entire dorsum. The lateral and posterior margins are often finely dentate or crenulate. The sternal shield is reticulate-punctate without a strong pattern of lines. The genital shield is usually reduced and rounded posteriorly. The ventrianal shield is reduced to a greater or lesser extent so that three pairs of apodemes are usually exposed; the number of ventrianal shield setae may be reduced to two, one, or no preanal pairs. Males have separate sternogenital and ventrianal shields, which may also be reduced. The lateral processes of the gnathotectum are usually reduced to narrow spikes and the median bifurcate process may be dissected distally. The fixed chela has an offset subterminal tooth and a central tooth, whilst the movable chela of the female has two central teeth; the male has a unidentate movable chela and a short, strongly tapered, posterodorsally directed spermatodactyl. The cheliceral dorsal seta is pectinate distally. The legs are highly rugose and have mainly pilose setae on most segments except coxa and tarsus I. The form of the spermathecal complex varies from the typical bilobed *Macrocheles* type through a stage with slightly enlarged rami and increasingly delicate membranous median organs to an extreme form with very elongate rami and indiscernible median organs similar to *Geholaspis* (*Longicheles*).

INCLUDED SPECIES. *M. opacus* (C. L. Koch), *M. analis* sp. nov., *M. dentatus* (Evans & Browning), *M. punctatissimus* Berlese, *M. terreus* (Canestrini & Fanzago).

The inclusion of *M. punctatissimus* in this species group is provisional. The group includes a series of species increasingly specialised by reduction of sclerotization and gnathotectal form, of which *M. punctatissimus* appears to represent the least specialised end. It shows little evidence of reduction of sclerotization except that the ventrianal shield is rather small and rounded. However, the dorsal chaetotaxy is the same as other members of the group and the chelicerae are of the *opacus* type.

Macrocheles opacus (C. L. Koch)
(Fig. 12A–E, Pl. 4B)

Macrholaspis opacus (C. L. Koch): Evans & Browning, 1956. *Bull. Br. Mus. nat. Hist.* (Zool.) **4**: 46.
Macrocheles (M.) opacus var. *aciculatus*: Krauss, 1970. *Acarologie* **14**: 23.

Evans & Browning placed this species in the genus *Macrholaspis* Oudemans, mainly on account of it having only two pairs of preanal setae on the ventrianal shield and crenulate margins to the dorsal shield. Krantz (1962) showed that there are closely related species having three pairs of preanal ventrianal setae and synonymised *Macrolaspis* with *Macrocheles*. The present authors also follow Krantz (1972) in synonymising *M. opacus* var. *aciculatus*, Krauss with *M. opacus*.

MATERIAL EXAMINED. 47 collections—7 PNN, 17 DNN, 88 ♀♀.

ENGLAND: Dorset, Gloucestershire, Berkshire, Surrey, Kent, Hertfordshire, Suffolk, Warwickshire, Worcestershire, Cumbria (Westmorland), Northumberland.

SCOTLAND: Strathclyde (Argyllshire), Dumfries & Galloway (Wigtownshire), Highland (Ross & Cromarty), Inner Hebrides (Mull, Ulva).

WALES: Glamorgan, Gwent, Gwynedd (Caernarvonshire), Clwyd (Denbighshire).

IRELAND: Clare, Galway, Mayo, Westmeath.

HABITATS. Collected in a variety of litter and soil habitats, but mainly in moss. Also found in rotten wood and an ants' nest.

DISTRIBUTION. Widespread in Europe, recent records include Germany (Krantz, 1973) and Spain (Athias-Henriot, 1968).

Macrocheles analis sp. nov.
(Fig. 13A–F, Pl. 5B)

FEMALE. The dorsal shield tapers from the shoulders posteriorly (Fig. 13A). It is ornamented with a raised polygonal reticular network which breaks up into small blunt tubercles anteriorly. The ornamentation is more rugose towards the shoulders. Between the main ornamentation there is fine granular microsculpture. The edges of the shield are smooth. There are twenty-nine pairs of pilose setae on the dorsal shield including both *J2* and *J3*.

The shields of the ventral surface are weakly sclerotized and reduced in size. The sternal shield has a fine granular texture and distinct reticulations posteriorly (Pl. 5B). The sternal and genital setae are pilose. The metasternal plates are small and round, only just large enough for the setae; the pores are separate in the unsclerotized membrane. The genital shield has a porous surface without reticulation. It is almost semicircular posteriorly and the genital pores are on the unsclerotized membrane. The postgenital apodemes are weakly sclerotized, barely discernible. The opisthogastric sclerotization is reduced to a small subcircular shield bearing the anal setae (Fig. 13B). The adanal setae are simple, longer than the postanal which is pilose. The *Jv* setae are simple, the other opisthogastric setae are strongly pilose. The spermathecal apparatus has elongate rami and indistinct median organs (Fig. 13C).

The gnathotectum has a bifid median process with the arms dissected and the lateral processes absent, the anterior edge is dentate (Fig. 13D). The fixed chela is basically bidentate with a central tooth and an offset subterminal tooth, it is truncate distally; the movable chela is bidentate (Fig. 13E). The dorsal seta is pectinate laterodistally. The corniculi are elongate (Fig. 13F), one-and-a-

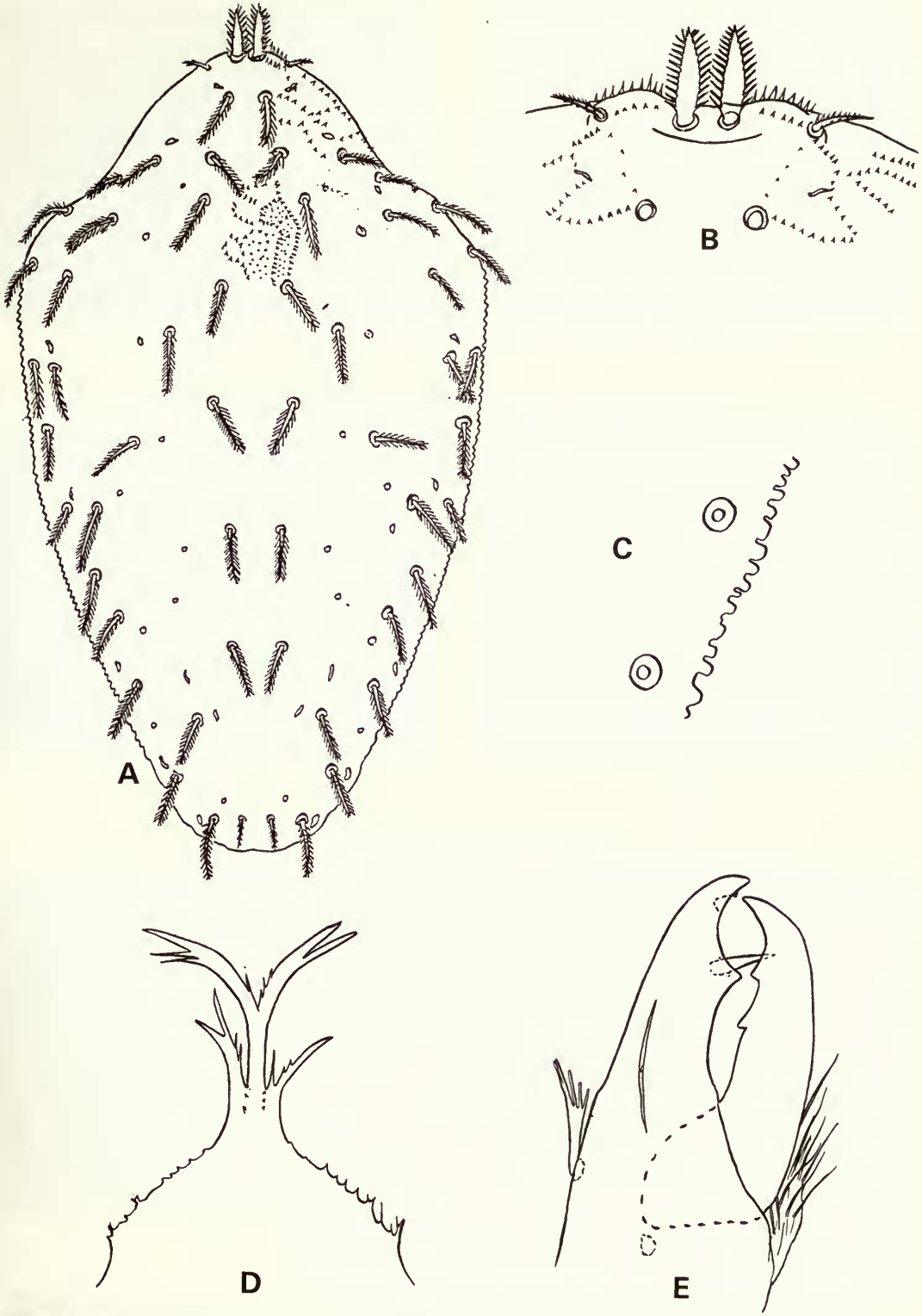


Fig. 12 *Macrocheles opacus* (C. L. Koch): **female**—A dorsal shield; B anterior region of dorsal shield; C lateral margin of dorsal shield; D gnathotectum; E chelicera. After Evans & Browning (1956).

A

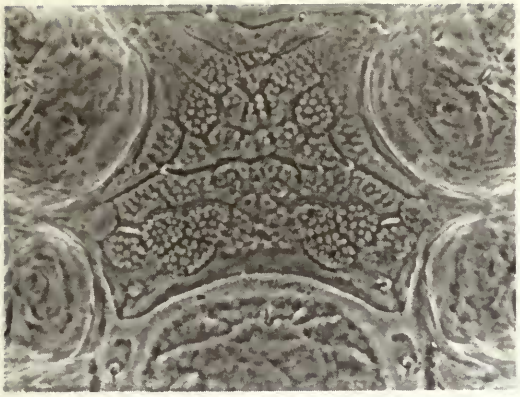
B

C

D

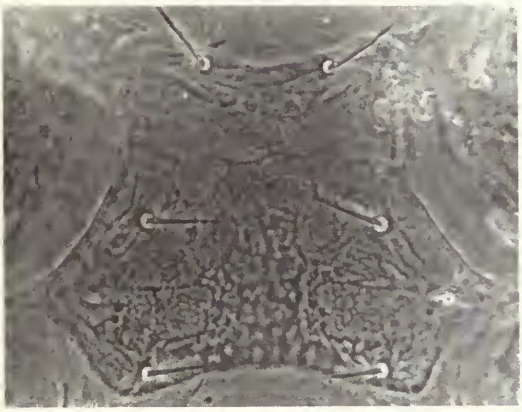
E

Plate 5 Sternal shields of the females of: A *Geholaspis (Longicheles) hortorum* (Berlese); B *Macrocheles analis* sp. nov.; C *Holostaspella ornata* (Berlese); D *H. exornata* Filipponi & Pegazzano; E *Glyptholaspis fimicola* (Berlese).



A

B



C

D

E

F

Plate 6 Sternal shields of the females of: A *Macrocheles rotundiscutis* Bregetova & Koroleva; B *M. punctatissimus* Berlese; C *M. terreus* (Canestrini & Fanzago); D *M. nataliae* Bregetova & Koroleva; E *M. subbadius* (Berlese); F *Glyptholaspis americana* (Berlese).

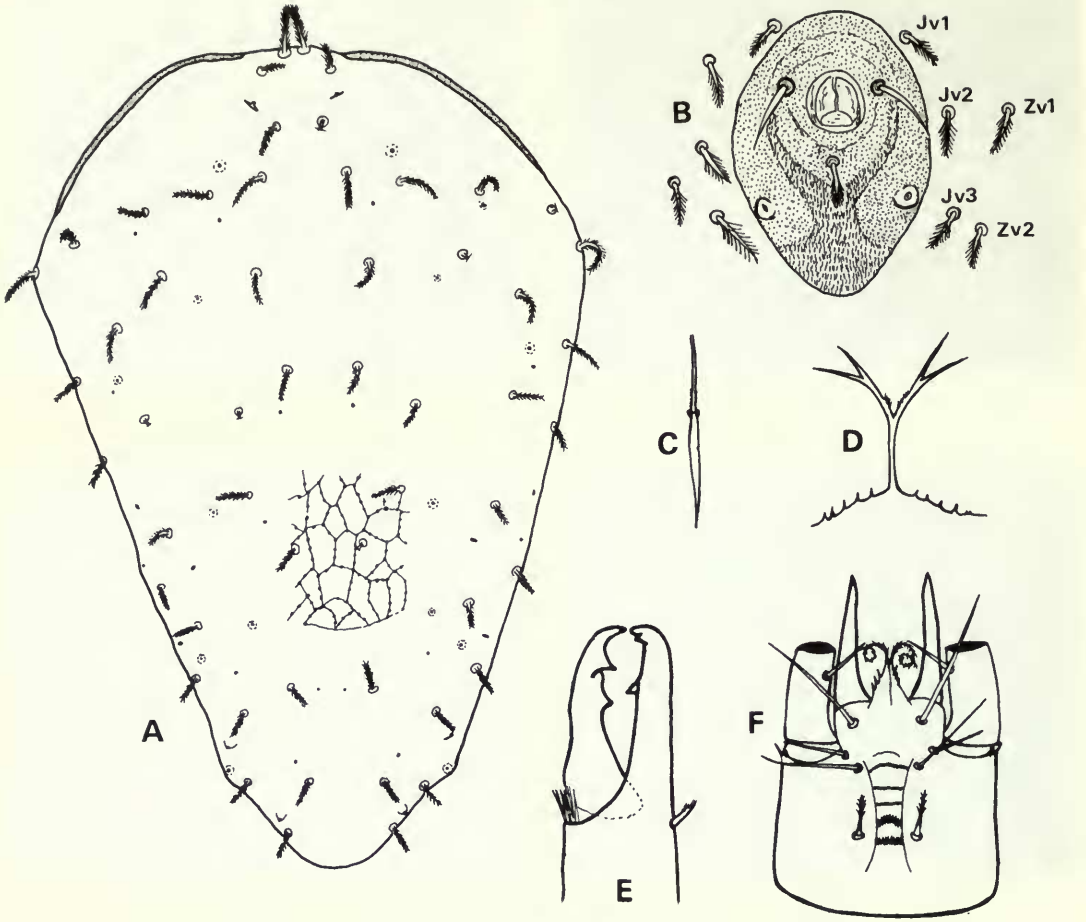


Fig. 13 *Macrocheles analis* sp. n.: **female**—A dorsal shield; B anal shield; C tubulus and ramus of spermathecal apparatus; D gnathotectum; E chelicera; F venter of gnathosoma.

half times as long as the pedipalp trochanter. The internal hypostomal setae are posterior to the external hypostomal setae. The hypognathal groove has two rows of strong denticles (*G5* and *G6* in Hirschmann's notation) and three fine rows (*G2, G3, G4*). The hollow seta on the external part of the palp tarsus, which is elongate in all known species of *Macrocheles*, is barely longer than the surrounding setae.

The legs have mainly pilose setae on all segments except coxa and tarsus I which have all setae simple.

TYPE MATERIAL. **Holotype** ♀, England, Berks, Silwood Park, 'light sandy loam with winter wheat', 23.xi.1963. [BMNH].

MATERIAL EXAMINED. Known only from the holotype in the British Isles, but two specimens from the U.S.A., apparently referrable to this species, have been seen; 1 ♀, Corvallis, Oregon, rotten bulb [OSUC] and 1 ♀, Lexington, Kentucky, duff.

REMARKS. This species represents the end of a series of species showing increasing reduction of the ventral shields and increasing specialisation of the gnathosoma and spermathecal apparatus in the direction of the condition found in *Geholaspis (Longicheles)*. It is probable that the reduction of sclerotization is an adaption to life in deeper soil layers.

Macrocheles dentatus (Evans & Browning)
(Fig. 14A–D, Pl. 4C)

Macrholaspis dentatus Evans & Browning, 1956. *Bull. Br. Mus. nat. Hist.* (Zool.) **4**: 49.
Macrocheles (M.) multisetosus Götz in Krauss, 1970. *Acarologie* **14**: 29. **Syn. nov.**

Evans & Browning (1956) described this species in the genus *Macrholaspis*, which was synonymised by Krantz (1962) with *Macrocheles*.

The type material of *M. multisetosus* Götz has not been examined, but the description and illustrations fail to show any significant difference between it and the holotype of *M. dentatus*, with the exception of four rather than three unpaired median dorsal setae. This character has been found to vary in material from collections in the British Isles and is not correlated with other characters. However, the original description of *M. dentatus* is misleading in that the setae on the membrane between the genital and ventrianal shields are stated to be plumose when in fact there are two pairs of simple setae, *Jv1* and *Zv1* (*V1* and *V5* in Hirschmann's notation), in this position in all specimens examined, including the holotype.

In their key to species of *Macrholaspis* Evans & Browning (1956) state that there is a strong tubercle on the posterior margin of trochanter IV. This is an error for femur III.

The Hull Collection includes a specimen labelled '*Macrocheles pannosus* 9 Bks.' [Ninebanks, Northumberland], which is a specimen of *M. dentatus*. Reluctantly the present authors have concluded that this cannot be the type of *M. pannosus* Hull, 1925, described from West Allendale, as it does not agree with the description either as to size or in the characters described.

TYPE MATERIAL. *M. dentatus*; **holotype** ♀, Wales, Cardiganshire, Dolybont, Leri Valley, in litter under bracken, viii.1954, G. O. Evans. [BMNH].

MATERIAL EXAMINED. 19 collections—2 DNN, 22 ♀♀.
ENGLAND: Cornwall, Devon, Somerset, Surrey, Kent, Cambridgeshire, Yorkshire, Northumberland.
SCOTLAND: Tayside (Perthshire).
WALES: Gwent, Dyfed (Cardiganshire).
IRELAND: Clare, Galway, Westmeath.

HABITATS. Bryophytes, leaf litter and grassland soil, also one collection from *Microtus agrestis*.

DISTRIBUTION. Evidently widespread but rarely collected in the British Isles; also known from Germany (Götz in Krauss, 1970, as *M. multisetosus*).

Macrocheles punctatissimus Berlese
(Fig. 14E–G, Pl. 6B)

Macrocheles (Nothrholaspis) punctatissimus Berlese, 1918. *Redia* **13**: 171.
Nothrholaspis pulcherrimus Willmann, 1951. *Sber. Akad. Wiss. Wien.* **160**: 104.

FEMALE. The dorsal shield (Fig. 14E) completely covers the dorsal surface. It is strongly ornamented with reticulations, the sides of the reticulations are crenate and within them there is a porose microsculpture. There are twenty-eight pairs of setae plus an unpaired median seta between *j6* and *J3* on the dorsal shield. Setae *j1* are slightly flattened, all other setae are of the usual tapering pilose variety. The lateral margins of the dorsal shield are smooth.

The sternal shield is strongly punctured all over; the punctures are arranged in groups to form a symmetrical pattern (Pl. 6B). The metasternal plates are rounded and include the pore. The genital shield is truncate posteriorly and not noticeably reduced. It is ornamented with a series of minute tubercles arranged in rows. The sternal and genital setae are simple. The ventrianal shield is rounded and closely abuts the genital, it bears three pairs of simple preanal setae. The postanal seta is pilose. The spermathecal complex is of the normal type within the genus *Macrocheles* with short rami joining a two-lobed sacculus (Fig. 14F).

The gnathosomal structures are typical of the genus *Macrocheles*. The gnathotectum has a median bifid process (Fig. 14G) and free lateral processes expanded and serrate at the distal end.

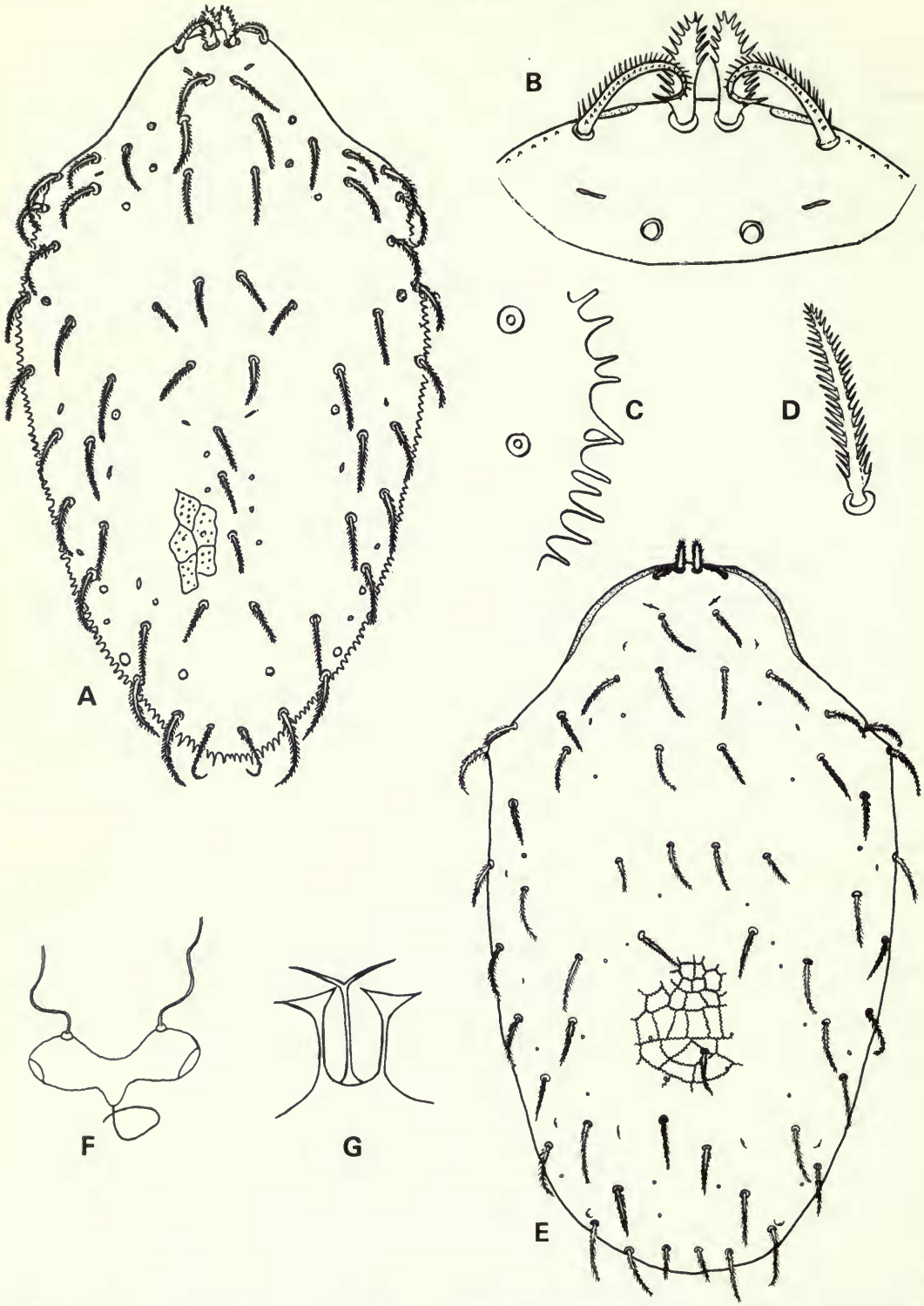


Fig. 14 *Macrocheles dentatus* Evans & Browning: **female**—A dorsal shield; B anterior region of dorsal shield; C lateral margin of dorsal shield; D dorsal seta *z4*. After Evans & Browning (1956). *Macrocheles punctatissimus* Berlese: **female**—E dorsal shield; F spermathecal apparatus; G gnathotectum.

The fixed chela is basically bidentate, including an offset terminal tooth. The movable chela is bidentate and the dorsal seta is slightly pectinate distally. The hypognathal groove has the usual five rows of denticles and hypostomal setae 2 and 3 are opposite each other.

The legs are normal for the species group, rugose and with the usual mixture of pilose and simple setae on most segments. Seta pl_1 on femur III is conspicuous and blade shaped.

TYPE MATERIAL. *Macrocheles punctatissimus*: **Syntypes** 2 ♀♀ 'Castions distruda (Udine), musco [moss]', slide 131/46 [ISZA].

MATERIAL EXAMINED. 2 collections—3 ♀♀.
ENGLAND: Cambridgeshire.

HABITATS. The first British record. From the bases of *Molinia* tussocks in Wicken Fen. Apparently found in similar places in Austria (as *pulcherrimus*).

DISTRIBUTION. Germany (Krauss, 1970), Austria (Willmann, 1951 as *pulcherrimus*).

REMARKS. No type material of *Nothrholaspis pulcherrimus* has been examined so the synonymy follows Krauss (1970). The species present in Britain is clearly conspecific with that described by Krauss (1970) and probably with that described by Willmann (1951).

Macrocheles terreus (Canestrini & Fanzago)
(Fig. 15A–B, Pl. 6C)

Gamasus terreus Canestrini & Fanzago 1877. *Atti R. Ist. veneto Sci.* (V) **4**: 48.
Holostaspis echinatus Berlese, 1904. *Redia* **2**: 20.
Holostaspis terreus (Canestrini & Fanzago), Halbert, 1915. *Proc. R. Ir. Acad.* **31**: 66.
Macrocheles (M.) opacus Krauss, 1970. *Acarologie* **14**: 22.
Macrocheles terreus (Canestrini & Fanzago); Krantz, 1972. *Ent. Mitt. zool. Mus. Hamburg* **4**: 270.

FEMALE. The dorsal shield has twenty-nine pairs of setae (Fig. 15A) including pairs in both the *J2* and *J3* positions. The setae are generally shorter and blunter than in other members of the species group and pilose or plumose almost to the base; setae *j1* are strongly flattened, almost fan-shaped. The dorsal shield ornamentation consists of faint reticulations and a dense microsculpture of fine pores. The lateral margins are bluntly dentate.

All the ventral shields are finely punctured, many of the punctures are arranged in lines. The setae on the ventral shields are basically simple, except the genital setae, which may appear finely pilose, and the pilose post anal seta. The sternal shield has a symmetrical pattern of punctate areas and lines of fine punctures. The metasternal platelets are elongate oval. The genital shield is semi-circular behind and the associated pores are free on the membrane. The subcircular ventrianal shield is well separated from the genital with three pairs of apodomes between. The median structures of the spermathecal complex are indistinct.

The gnathosoma is typical of the species group with free spike-like lateral processes on the gnathotectum and the chelae with offset subterminal and central teeth on the fixed chela and two central teeth on the movable chela (Fig. 15B). The hypognathal groove has six rows of denticles.

The legs are normal for the species group except that many setae are somewhat flattened or blade-like instead of pilose.

TYPE MATERIAL. *H. echinatus*: **Lectotype** ♀ (here designated), Italy, Firenze, Boboli, Foglia marce palme, 'tipico *M. echinatus* Berl.' slide 22/38 [ISZA]. *G. terreus*: **Neotype** ♀ (here designated), the lectotype of *H. echinatus*, from Firenze, Italy, slide 22/38 [ISZA].

Although Berlese indicated a type designation on slide 22/38 and in his notebooks, this designation was not published.

MATERIAL EXAMINED. 6 collections—6 ♀♀.
ENGLAND: Hampshire, Kent, Suffolk, North Yorkshire, Humberside.
IRELAND: Mayo (Halbert, 1915).

HABITAT. From arable and grassland soils and beech forest litter, also recorded from moss and leaf litter by Krauss (1970) and from moss and under bark by Halbert (1915).

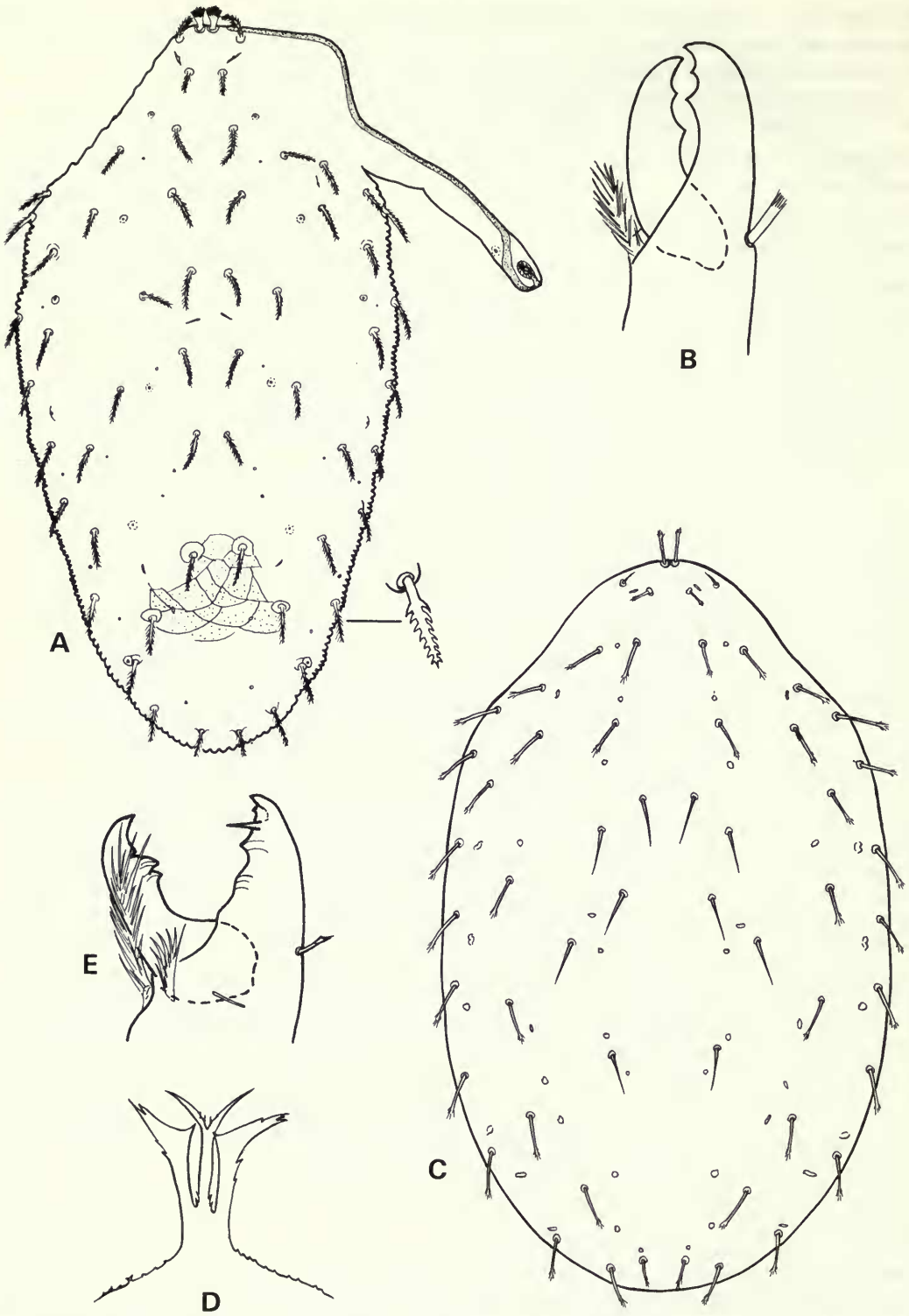


Fig. 15 *Macrocheles terreus* (Canestrini & Fanzago): **female**—A dorsal shield with right seta *S4* enlarged; B chelicera. *Macrocheles muscaedomesticae* (Scopoli): **female**—C dorsal shield; D gnathotectum; E chelicera. After Evans & Browning (1956).

DISTRIBUTION. According to Krauss (1970) it is known from Germany and Spain (as *opacus*). Since Krauss's concept of *M. opacus* varies from that of most other authors, the literature records he cites are probably for several species.

REMARKS. The original material of *Gamasus terreus* was stated (Canestrini & Fanzago, 1877) to have come from Padova. The type material is not present in the Canestrini Collection in Padova (see remarks under *M. tardus*) and must be presumed lost.

Valle (1955) records two vials listed under *terreus* in the catalogue of the Canestrini Collection. The first vial (jar no. XX, vial no. 703) apparently contained specimens of *terreus* from Rome, when seen by Valle, but now only contains two feather-mites. The other vial (jar no. XIII, vial no. 504) contained *Geholaspis longispinosus* when seen by Valle, but is now empty. It is labelled 'Messina'. Neither of these vials could have contained the types as these came from Padova.

In the absence of Canestrini and Fanzago's type material of *G. terreus* a neotype has been selected, this is necessary in view of the likelihood of there being a complex of closely similar species centred on *M. terreus*.

The lectotype specimen of *echinatus* has been chosen as neotype of *terreus*. This will have the effect of making *echinatus* an objective synonym of *terreus* and confirming a synonymy indicated by Berlese on the slide of *echinatus* and in his notebooks.

Berlese's (1904) original drawing of *echinatus* (Plate II, Fig. 33) differs from his later drawing in his notebook and from the designated type of *echinatus* in having a truncate posterior margin to the genital shield and in having a larger, more triangular ventrianal shield.

Macrocheles terreus evidently belongs to a complex of very closely related species within the *opacus* species group of which *M. beieri* Johnston from Austria may be a member. It is possible that the species described above may also represent a different taxon based on the simple setae of the ventral shields, the six rather than five rows of hypognathal denticles and fine differences in the sculpture of the shields. However, a decision on this must await the discovery of more British material and direct comparison of the various forms involved.

The present authors have followed Krantz (1972) in the synonymy of *M. opacus*, Krauss, with *M. terreus* (Canestrini & Fanzago).

Macrocheles muscaedomesticae (Scopoli)
(Fig. 15C–E, Pl. 1A)

The description and synonymy of this species as given by Evans & Browning (1956) remain correct.

MATERIAL EXAMINED. 27 collections—76 ♀♀, see below.

ENGLAND: Cornwall, Devon, Wiltshire, Hampshire, Sussex, Surrey, Kent, London, Essex, Middlesex, Hertfordshire, Cambridgeshire, Lancashire, Cheshire.

A sample from a deep-litter house in which partridges *Perdix perdix* were being reared in Cambridgeshire in 1978 contained thousands of females of this species.

HABITATS. Mostly associated with synanthropic flies, i.e. *Musca domestica, Fannia* spp., *Stomoxys calcitrans*, also with fly breeding places, compost heaps, rotting seaweed and artificial nests of rats.

DISTRIBUTION. Apparently cosmopolitan wherever suitable phoretic hosts exist, although surprisingly, the only British material examined is from England.

Macrocheles pisentii (Berlese)

This species almost certainly does not occur in the British Isles. Its inclusion by Evans & Browning (1956) was based on three records of Hull (1918), but they were unable to examine his specimens. The present authors have examined material labelled as *M. pisentii* in the Hull Collection, but without locality data, and found it to be *M. glaber*.

Costa (1967) has shown *M. pisentii* to be very closely associated with *Scarabaeus semipunctatus* F., even to the exclusion of other species of *Scarabaeus*. Since *S. semipunctatus* is not present in the British fauna it seems that *M. pisentii* is also unlikely to be present.

Costa (1967) redescribed *M. pisentii* and distinguished it from other closely related species.

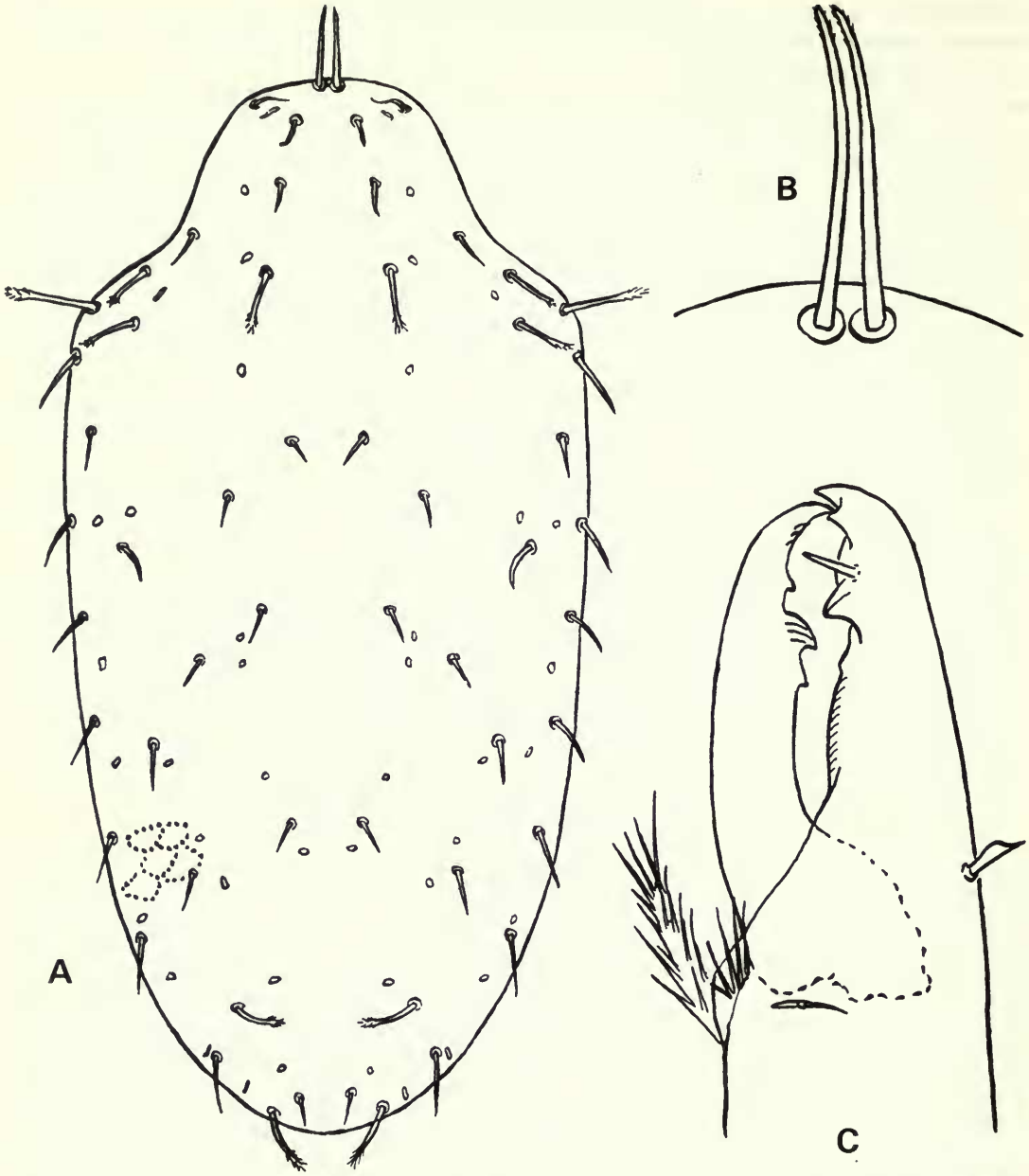


Fig. 16 *Macrocheles robustulus* (Berlese): **female**—A dorsal shield; B seta *j1*; C chelicera. After Evans & Browning (1956).

Macrocheles robustulus (Berlese)
(Fig. 16A–C, Pl. 1B)

Holostaspis subbadius var. *robustulus* Berlese, 1904. *Redia* **1**: 264.
Holostaspis humeratus Berlese 1908. *Redia* **5**: 13.
Nothrholaspis punctillatus Willmann, 1939. *Abh. naturw. Ver. Bremen* **31**: 176.
Macrocheles coprophila Womersley, 1942. *Trans. Roy. Soc. S. Aust.* **66**: 167.
Macrocheles rothamstedensis Evans & Browning, 1956. *Bull. Br. Mus. nat. Hist.* (Zool.) **4**: 15.
Macrocheles robustulus: Axtell, 1961. *Ann. ent. Soc. Am.* **54**: 748.

The first British record of this species was that of Evans & Browning (1956) who described it under the name *M. rothamstedensis*. This was synonymised with *M. punctillatus* (Willmann) by Bregetova & Koroleva (1960) and with *M. robustulus* (Berlese) by Axtell (1961). For the complete synonymy see Krantz & Filipponi (1964).

Evans & Browning's (1956) description needs no amendment.

MATERIAL EXAMINED. 3 collections—3 ♂♂, 64 ♀♀.
ENGLAND: Essex, Hertfordshire, Bedfordshire.

HABITATS. Cattle dung, 'colony on cucumber leaves'. Elsewhere this species is most often collected from cattle manure (Axtell, 1961), and phoretic on scarabaeine beetles (Costa, 1966*a*).

DISTRIBUTION. Widespread in temperate regions of the world; Italy (Filipponi & Pegazzano, 1962), Germany (Krantz, 1972), U.S.S.R. (Bregetova & Koroleva, 1956), Israel (Costa, 1966*a*), U.S.A. (Axtell, 1961), Australia (Krantz & Filipponi, 1964), New Zealand (Emberson, unpublished).

glaber group

This species group was defined by Filipponi & Pegazzano (1962) and is here slightly modified to include another obviously related species. The species are medium sized with the 28 pairs of setae on the dorsal shield being mainly simple, but there are from four to ten pairs that are pilose. These usually include *j1, j4, z3* which are pilose distally and *J5* pilose over their entire length. Males usually have additional pilose setae. The dorsal shield is lightly ornamented with transverse reticulations and, in the females, is divided by a procurved line passing close to the bases of setae *z6* and extending laterally towards setae *r4* (Fig. 17A). The lateral margins are smooth. The male dorsal shield is strongly tapered posteriorly with crenulate lateral and posterior margins. The type of sternal shield pattern is characteristic, with lines often edged with punctures. The *linea media transversa* is well developed and straight, the *linea angulata* is similar in all species and there are one or two *lineae arcuatae* of varying form. Behind the *linea media transversa* the *lineae obliquae posteriores* are bifurcate distally and the *areae punctatae posteriores* are well developed. The ventrianal shield is usually more or less pentagonal and ornamented with concentric lines and reticulations, at least anteriorly. The males have separate sternogenital and ventrianal shields. All the ventral setae are simple, except the postanal which is finely serrated. The gnathotectum has free lateral processes and a bifurcate median process which is minutely spiculate medially. The fixed chela is bidentate, with a proximal major tooth and a distal minor one, it is bidentate or tridentate in the male. The movable chela is basically tridentate with two adjoining proximal teeth, lacking in the male, and a minor distal tooth. The spermatodactyl extends dorsally then posteriorly and is about the length of the movable chela. The cheliceral dorsal seta is simple to slightly lanceolate. The legs have mainly simple setae with some pilose setae on trochanters, femora, genua and tibiae. The male leg armature consists of complex spurs on trochanter and femur IV, a strong spur on femur II and a series of other small spurs and tubercles on the genua, tibiae and tarsi of legs II and IV. The spermathecal sacculus is of the normal two-lobed variety with the lobes close together and broadly joined, the corniculum is wide, almost cup-shaped.

INCLUDED SPECIES. *M. glaber* (Müller), *M. nataliae* Bregetova & Koroleva, *M. scutatus* (Berlese).

M. nataliae, here included in the *glaber* group, is obviously closely related to the other species although it differs slightly from them in having setae *j4* and *z3* simple, and the *lineae obliquae posteriores* are not obviously bifurcate as they are in other species. Krantz (1981), in describing *M. eurygaster*, assigned it to the *glaber* group in spite of setae *j4* and *z4* being simple in the female. They are pilose distally in the immatures and males.

Macrocheles glaber (Müller)
(Fig. 17A–D, Pl. 1C)

The description and synonymy given by Evans & Browning (1956) remain adequate although Filipponi & Pegazzano (1962) have redescribed this species and give an extended synonymy, including *M. alecto* Berlese and its varieties.

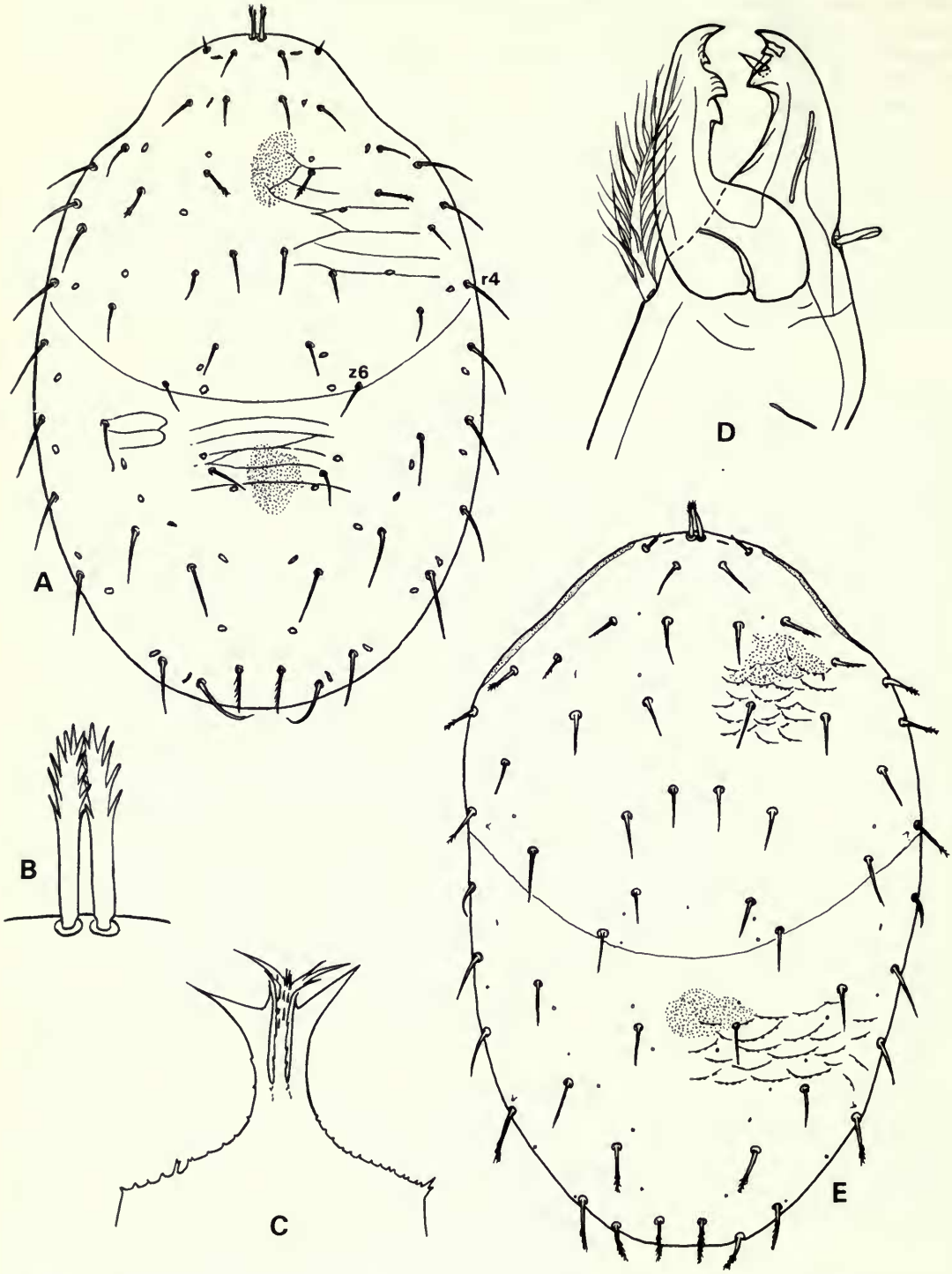


Fig. 17 *Macrocheles glaber* (Müller): **female**—A dorsal shield; B seta *j1*; C gnathotectum; D chelicera. After Evans & Browning (1956). *Macrocheles nataliae* Bregetova & Koroleva: **female**—E dorsal shield.

TYPE MATERIAL. *M. alecto*: **Syntype** ♀ only, Italy, Firenze, Giarbino R. Stazione, humus. Slide 186/15 [ISZA]. *Holostaspis marginatus* var. *littoralis* Halbert, 1915: **Lectotype** ♀ here designated, Westport, Co. Mayo, Ireland, on seashore, July 1910. Slide 55—1923 [National Museum of Ireland, Dublin]. **Paralectotypes** 2 ♀♀ on same slide, same data, 1 ♂ (dissected) on two separate slides, both 55—1923, also same data.

MATERIAL EXAMINED. 170 collections—9 DNN, 42 ♂♂, *c.* 3, 100 ♀♀.

ENGLAND: Isles of Scilly, Cornwall, Devon, Dorset, Gloucestershire, Somerset, Isle of Wight, Hampshire, Sussex, Surrey, Kent, London, Essex, Middlesex, Hertfordshire, Buckinghamshire, Suffolk, Norfolk, Cambridgeshire, Warwickshire, Derbyshire, Yorkshire, Lancashire, Cheshire, Cumbria (Cumberland, Westmorland), Northumberland.

SCOTLAND: Dumfries & Galloway (Kirkcudbrightshire), Strathclyde (Argyllshire), Inner Hebrides (Mull), Outer Hebrides (Shillay), Shetland.

WALES: Dyfed (Cardiganshire), Gwynedd (Anglesey, Caernarvonshire, Merionethshire), Clywd (Denbighshire).

IRELAND: Cork, Clare, Galway, Mayo.

HABITATS. Most often collected associated with coprophagous beetles (79 collections), records include: *Geotrupes mutator* Marsham, *G. pyrenaeus* Charpentier, *G. spiniger* Marsham, *G. stercorosus* (Scriba), *G. vernalis* (L.), *Typhaeus typhoeus* (L.), *Aphodius rufipes* (L.) and *A. scybalarius* (F.). *M. glaber* has also been collected from burying beetles *Nicrophorus humator* F., (2 collections), from bumble bees *Bombus agrorum* F., from a fox corpse (Smith, 1975), from small mammals and their nests, and from a variety of manure and rotting vegetation habitats, including occasionally seaweed.

DISTRIBUTION. Found everywhere in the British Isles where suitable habitats occur and probably in most temperate regions of the world. Filipponi & Pegazzano (1962) report it as widespread in Europe and the Mediterranean area. Outside these areas it has been recorded throughout the U.S.S.R. (Bregetova & Koroleva, 1960), U.S.A. (Axtell, 1963) and New Zealand (Emberson, 1973*a*).

Macrocheles nataliae Bregetova & Koroleva
(Fig. 17E, Pl. 6D)

Macrocheles nataliae Bregetova & Koroleva, 1960. *Parazit. Sb.* **19**: 140.
Macrocheles (Macrocheles) melisii Krauss, 1970. *Acarologie* **14**: 24. **Syn. nov.**

FEMALE. The dorsal shield (Fig. 17E) is ornamented with mainly transverse reticulations and a microsculpture of very fine regular punctations. There are twenty-eight pairs of setae on the dorsal shield of which *j1, z2, s2, r2, r3, r4, J5, Z4, Z5, S4* and *S5* are pilose distally, other dorsal setae are simple.

The sternal shield (Pl. 6D) has a characteristic pattern of lines and fine punctures, there are no coarse punctures. The *linea media transversa* is well defined, there is one *linea arcuata* which tends to be concave anteriorly and meet with polygonal reticulations laterally. There is an area of fine punctures just posterior to the *linea angulata*. The *lineae obliquae posteriores* are poorly defined and not noticeably bifurcate. The *areae punctatae posteriores* are represented mainly by a series of fine edging punctures. The metasternal plates are small elongate-ovate. The genital shield is weakly ornamented, with fine lines and punctures. The ventrianal shield is noticeably longer than broad and ornamented with more or less concentric reticulations anteriorly which tend to become polygonal posteriorly.

The gnathosoma is typical of the species group, the gnathotectum having free lateral processes and a bifurcate median process which is minutely spiculate in the fork. The fixed chela has one major tooth and one minor distal tooth, the movable chela is tridentate, the two proximal teeth arising from a common base; the cheliceral dorsal seta is slightly flattened and leaf-shaped.

The legs are normal for the group with a mixture of simple setae and stubby, faintly pilose setae on all segments except the coxae, trochanters, and on leg I, the tibia and tarsus.

MALE. The male is unknown in the British Isles. Krauss (1970) described a male which is probably this species (as *melisii*), it differs from other males of the species group mainly in the distribution of pilose dorsal setae.

TYPE MATERIAL. *M. nataliae*: 1 ♀ **syntype**, Lithuanian S.S.R., Plunge, on the corpses of *Microtus arvalis*, 11.vii.1954, coll. Likyavichene [ZINL]. 1 ♀ **syntype**, Tatar A.S.S.R., Kuibyshev region, in soil at experiment station, under grass 11.vi.1957, coll. Aleinikova [ZINL].
The type material of *M. melisii* was not available for study, but there can be little doubt of the synonymy based on the description and drawing of Krauss (1970).

MATERIAL EXAMINED. 6 collections—20 ♀♀.
ENGLAND: Cornwall, Hampshire, London, Lincolnshire.

HABITATS. The first record for the British Isles. On burying beetles *Nicrophorus humator* F., *N. investigator* Zett. and *N. vespillo* L. Bregetova & Koroleva (1960) report it from a variety of small mammals and also from soil samples, whilst Bregetova *et al.* (1977) record it from *Geotrupes*.

DISTRIBUTION. Widespread in U.S.S.R., from Lithuanian SSR, to the Maritime region of Siberia (Bregetova & Koroleva, 1960); also reported from Germany (Karg, 1970; Krauss, 1970).

REMARKS. There are several small inconsistencies in the details of the description and drawings of Bregetova & Koroleva (1960) both when compared with their syntypes and with British material. They do not describe setae *z2, s2, Z4* and *S3* as pilose and seta *r4* is described as pilose but drawn simple, these setae are only very faintly pilose in British material. They mention that there is some variation in the presence of pilose setae and certainly in two syntypes examined *z2* was simple, although it is pilose in British material. Krauss (1970) also records it as simple. The other setae mentioned were pilose in both syntypes from the U.S.S.R., in British material and in that illustrated by Krauss (1970). It appears that there may be some slight variation in the distribution of pilose dorsal setae but this is perhaps not surprising in a species distributed across the whole of the Palaearctic region.

Macrocheles scutatus (Berlese)
(Fig. 18, Pl. 1E)

Holostaspis subbadius var. *scutatus* Berlese, 1904. *Redia* **1**: 264.
Macrocheles subbadius: Evans & Browning, 1956, *non* Berlese, 1904. *Bull. Br. Mus. nat. Hist.* (Zool.) **4**: 19.
Macrocheles scutatus (Berlese): Filipponi & Pegazzano, 1962. *Redia* **47**: 228.

The female of this species is adequately described by Evans & Browning (1956) under the name *M. subbadius* (Berlese) which Filipponi & Pegazzano (1963) have shown to be a completely different species.

The male has been described on the basis of reared material by Filipponi & Pegazzano (1962). It differs from related species chiefly in the distribution of pilose dorsal setae, in details of the shape and ornamentation of the ventral sclerotisation and in the leg armature.

MATERIAL EXAMINED. 5 collections—17 ♂♂, 24 ♀♀.
ENGLAND: Worcestershire, Derbyshire, Yorkshire.
WALES: Glamorgan.

HABITATS. Farmyard manure. Filipponi & Pegazzano (1962) record this species from dung and compost habitats, also associated with coprophagous beetles, but not muscid flies.

DISTRIBUTION. Italy (Filipponi & Pegazzano, 1962), U.S.S.R. (Bregetova & Koroleva, 1960—as *M. subbadius*—and Bregetova *et al.*, 1977), New Zealand (Emberson, 1973*b*). The continuing confusion of closely related species, including *M. vicinus* Leitner (1946), makes assessment of the distribution of this species problematical.

***subbadius* group**

This species group was reviewed by Filipponi & Pegazzano (1963) who defined it as consisting of small species, with 28 pairs of simple needle-like setae in the females, with setae *j1* short, spine-like

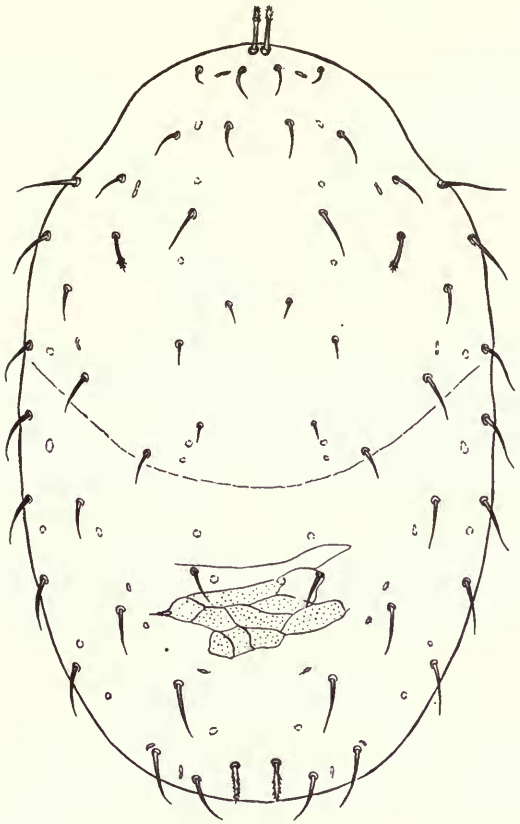


Fig. 18 *Macrocheles scutatus* (Berlese): **female**—dorsal shield. After Evans & Browning (1956).

and diverging. The dorsal shield of males is more or less strongly tuberculate posteriorly, and has at least two pairs of large blunt, slightly spatulate setae (*j4, z4*). The ventral shields are ornamented with a series of punctate lines; in the females the sternal shield has the *lineae oblique anteriores* connected transversely by 4 or 5 lines, the most posterior of which is the *linea media transversa*. All the ventral setae are simple. The males have a holoventral shield. The gnathotectum has the lateral processes free and the median process bifurcate and minutely spiculate distally. Both chelae are basically bidentate in the female, but in the male the fixed chela is tridentate and the movable chela unidentate; the dorsal seta is simple and the spermatodactyl is elongate, tapering, strongly recurved and almost twice as long as the movable digit. All the leg setae are simple, although spinose on tarsi II–IV. The males have the femora, genua, tibiae and tarsi of legs II armed with spines and tubercles, leg III is unarmed and the armature of leg IV is more variable.

INCLUDED SPECIES: *M. subbadius* (Berlese), *M. insignitus* Berlese and *M. merdarius* (Berlese).

Macrocheles subbadius (Berlese)
(Fig. 19A, Pl. 6E)

Holostaspis subbadius Berlese, 1904. *Redia* **1**: 264. *non Macrocheles subbadius*, Evans & Browning, 1956. *Bull. Br. Mus. nat. Hist.* (Zool.) **4**: 19.

The species described as *M. subbadius* by Evans & Browning (1956) is in fact *M. scutatus* (*vide* Filipponi & Pegazzano, 1962). However, *M. subbadius* does occur in the British Isles and a short description is given below. For a detailed description and synonymy see Filipponi & Pegazzano (1963).

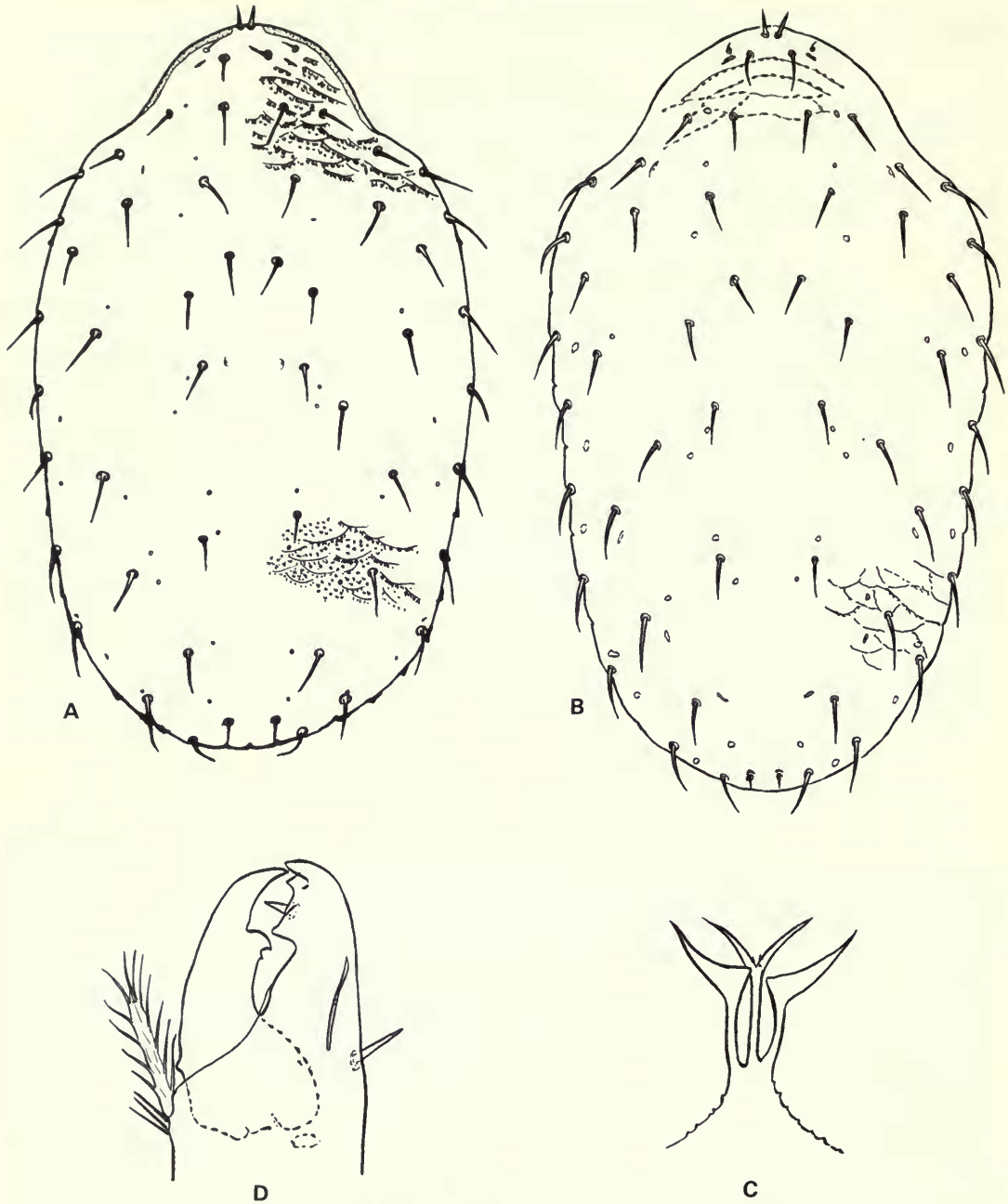


Fig. 19 *Macrocheles subbadius* (Berlese): **female**—A dorsal shield. *Macrocheles merdarius* (Berlese): **female**—B dorsal shield; C gnathotectum; D chelicera. B–D after Evans & Browning (1956).

FEMALE. The dorsal shield (700–750 μm long × 400–440 μm wide) is punctate-reticulate, the lateral margins are slightly dentate and the posterior margin has three small incisions between setae *Z5* (Fig. 19A).

The sternal shield is strongly patterned with punctate lines (Pl. 6E) and the *lineae oblique anteriores* are connected by five transverse lines, the most posterior of which, the *linea media*

transversa, is straight. Genu IV has seven setae, seta pl_1 being present. Other characters similar to those of *M. insignitus*.

MALE. Unknown from the British Isles, but distinguished from *M. insignitus* and *M. merdarius* by having only two pairs of enlarged dorsal setae and three pairs of dorsal tubercles, also tarsus II lacks a strong medial spine and femur IV has a strong spur (Filipponi & Pegazzano, 1963).

TYPE MATERIAL. Lectotype ♀, Italy, Padova, letamai [manure], 1882, Vecchia coll. Designated by Filipponi & Pegazzano, 1963, slide 19/41 [ISZA].

MATERIAL EXAMINED. 7 collections—40 ♀♀.
ENGLAND: Surrey, Oxfordshire, Northumberland, Cheshire.
IRELAND: Clare.

HABITATS. The first record for the British Isles. Phoretic on houseflies and in garden refuse. It has also been found on other species of flies and in manure. Thirteen females were removed from 11 specimens of the dipteran *Meroplius minutus* Wiedemann (Sepsidae) from Goring-on-Thames, Oxfordshire, coll. A. C. and B. Pont, 26.8.1985. Ten of the flies were carrying one apiece and the eleventh was carrying three when examined by K.H.H., although a few of the mites had been lost during the setting of the flies. They were attached to the ventral side of either the abdomen or the thorax.

DISTRIBUTION. Widespread in temperate regions. Italy (Filipponi & Pegazzano, 1963), Germany (Karg, 1971), U.S.A. (Axtell, 1961), New Zealand (Emberson, 1973*b*).

Macrocheles insignitus Berlese
(Pl. 1F)

The description of the female of this species as given by Evans & Browning (1956) needs no amendment. The male has been described from rearing experiments by Filipponi & Pegazzano (1963).

TYPE MATERIAL. **Holotype** ♀, France, Longuy Orne, musco [moss] Cordier coll., slide 58/50 [ISZA].

MATERIAL EXAMINED. 4 collections—1 ♂, 3 ♀♀.
ENGLAND: Norfolk, Warwickshire, Lancashire.
WALES: Gwynedd (Caernarvonshire).

HABITAT. Grass cuttings, compost, nest of bumble-bees *Bombus* sp. and wet mosses.

DISTRIBUTION. France, Italy (Filipponi & Pegazzano, 1963). Apparently a European species that is only rarely collected.

Macrocheles merdarius (Berlese)
(Fig. 19B–D, Pl. 2A)

Holostaspis merdarius Berlese, 1889. *Acari, Myriapoda et Scorpiones, etc.* Fasc. 52, T.1.
Holostaspis adulescens Berlese, 1910. *Redia* **6**: 252.
Macrocheles merdarius: Sellnick, 1940. *Göteborgs K. Vetensk.-o. vitterhSamh. Handl.* B **6**, 14: 86.

The description of the female given by Evans & Browning (1956) remains unchanged. The male remains unknown in collections from the British Isles, but has been redescribed by Filipponi & Pegazzano (1963).

TYPE MATERIAL. **Neotype** ♀, Italy, Vittorio, Veneto, letamai [manure]. Designated by Filipponi & Pegazzano (1963). Not seen, but slide material from the same collection has been examined, slides 89/15, 17, 46, 48 [ISZA].

MATERIAL EXAMINED. 3 collections—*c.* 30 ♀♀.
ENGLAND: Surrey, Hertfordshire.

HABITATS. Two collections from cattle dung and stable manure and one collection from a guinea-pig breeding unit. Elsewhere this species has been collected from flies.

DISTRIBUTION. *M. merdarius* appears to be practically cosmopolitan and has been recorded from many countries in Europe, the Americas, Africa and Australia (*vide* Filipponi & Pegazzano, 1963). In addition to these records it has been reported from Israel (Costa, 1966*b*) and New Zealand (Emberson, 1973*a*).

Genus *GLYPTHOLASPIS* Filipponi & Pegazzano

Glyptholaspis Filipponi & Pegazzano, 1960. *Redia* **45**: 136. Type species: *Nothrholaspis fimicola* Sellnick, 1931 = *Gamasus tardus* Berlese, 1882. *non* C. L. Koch, 1841.

All the shields are strongly reticulate. The posterior and lateral margins of the dorsal shield are dentate, with 28 pairs of setae, supernumerary setae are sometimes present between setae *j6* and *J2*. The sternal shield has a characteristic raised polygonal pattern (Pl. 3C) and extends posteriorly to the level of the posterior margins of coxae III, where it abuts rounded metasternal platelets. The genital and ventrianal shields also have a raised polygonal pattern; the ventrianal shield is truncate and angled anteriorly and rounded posteriorly. The median process of the gnathotectum is strongly bifid and spiculate, the lateral processes are sometimes partially fused basally. The fixed chela has four or five teeth in the female and three in the male, the movable chela usually has three teeth in the female and one in the male, the dorsal seta is dentate distally and the male spermatodactyl is simple, dorsally directed, tapering and recurved distally. The male has a holoventral shield and spurs on legs II, III and IV.

Filipponi & Pegazzano (1960) erected the genus for a clearly defined group of species formerly included in the genus *Macrocheles* under a variety of names. There is however some doubt as to the rank that should be assigned to this group (Krantz, 1962).

The recent synonymy of the three species of *Glyptholaspis* found in the British Isles with *Macrocheles tardus* (C. L. Koch) by Krauss (1970) cannot be supported, whether the genus *Glyptholaspis* is accepted or not. Filipponi & Pegazzano (1960) have shown the three species to be consistently different morphologically, in samples from various parts of the world, and Filipponi & Ilardi (1958) showed them to be reproductively isolated. The present authors also follow Sellnick (1931) and most other recent European authors in regarding *Gamasus tardus* C. L. Koch, 1841, as being a common European *Macrocheles* species in moss and leaf litter, whereas the *Glyptholaspis* species, including Berlese's 1882 concept of *Gamasus tardus*, are usually found in compost heaps, dung and associated with flies. Three species are known from the British Isles, two of which were previously confused under the name *Macrocheles plumiventris* Hull. All species are described in detail with full synonymies by Filipponi & Pegazzano (1960).

Key to the species of *Glyptholaspis* known to occur in the British Isles

1 Posterior margin of the dorsal shield between setae *Z5* with five large teeth, and, in the females, numerous minute teeth, setae *j6* and *z6* more or less in a straight line, seta *J5* no longer than setae *Z5*; trochanter II of male with a spur 2

– Posterior margin of the dorsal shield between setae *Z5* with two large teeth and numerous minute teeth (Fig. 20A), setae *j6* anterior to setae *z6*, setae *J5* distinctly longer than setae *Z5*; trochanter II of male unarmed . . . . . ***Glyptholaspis americana*** (Berlese) (p. 116)

2 Setae *j5* strongly pilose and erect, setae *J5* shorter than *Z5*; gnathotectum with lateral processes fused (Fig. 20E); female sternal shield pattern symmetrical, with a posterior median ridge (Pl. 3C); male trochanter IV with three subequal ventral spurs, femur IV unarmed . . . . . ***Glyptholaspis confusa*** (Foà) (p. 116)

Setae *j5* lightly pilose and adpressed, setae *J5* about equal in length to *Z5* in the female; gnathotectum with lateral processes free. Female sternal pattern asymmetrical, without a distinct posterior median ridge (Pl. 5E); male trochanter IV and femur IV each with a posteriorly directed spur . . . . . ***Glyptholaspis fimicola*** (Sellnick) (p. 117)

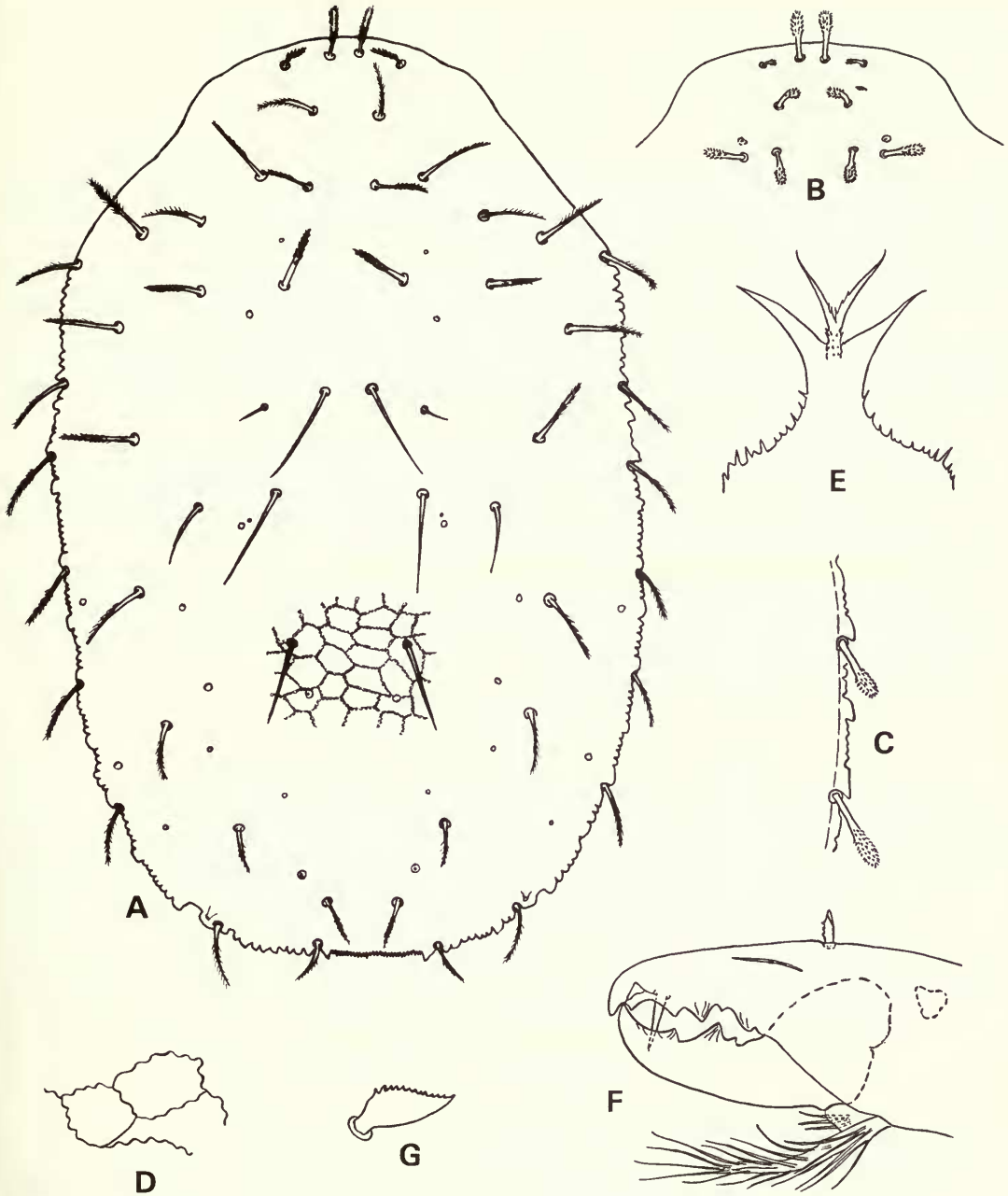


Fig. 20 *Glyptholaspis americana* (Berlese): **female**—A dorsal shield. *Glyptholaspis confusa* (Foà): **female**—B anterior region of dorsal shield; C lateral margin of dorsal shield; D ornamentation of dorsal shield; E gnathotectum; F chelicera; G dorsal seta of chelicera. B–G after Evans & Browning (1956).

Glyptholaspis americana (Berlese)
(Fig. 20A, Pl. 6F)

Holostaspis marginatus var. *americanus* Berlese, 1888. *Boll. Soc. ent. ital.* **20**: 195.
Holostaspis vagabundus Berlese, 1889. *Acari, Myriopoda et Scorpiones, etc.* Fasc. 52, T. 9.
Macrocheles tardior Hull, 1925. *Ann. Mag. nat. Hist.* (9) **15**: 126. **Syn. nov.**
Glyptholaspis americana (Berlese): Filipponi & Pegazzano, 1960. *Redia* **45**: 148.
Macrocheles (M.) tardus: Krauss, 1970. *Acarologie* **14:** 20, *partim, nec* C. L. Koch, 1841.

FEMALE. The dorsal setae *j6, J2* and *z5* are glabrous, setae *j5, z6* and *J5* are slightly pilose, other setae are strongly pilose. Setae *j5, j6, z6* and *J2* are relatively long and slender, of similar length; setae *J5* are distinctly longer than setae *Z5*. The posterior and lateral margins of the dorsal shield are strongly dentate, the posterior margin between setae *Z5* has two large teeth and an even row of minute ones (Fig. 20A).

All ventral shields are strongly reticulated with raised polygonal pattern. Sternal shield pattern (Pl. 6F) slightly asymmetric without a distinct median posterior ridge. Sternal and metasternal setae simple, genital setae moderately plumose, setae *Jv1–3* plumose, adanal setae simple, postanal seta short and plumose.

The gnathotectum has fused lateral processes and a bifurcate median process. The fixed chela has four teeth, the movable chela has three teeth.

The legs are normal for the genus with plumose setae on all segments except tarsus I.

MALE. The male is unknown from the British Isles, but has been adequately described by Filipponi & Pegazzano (1960). The main distinguishing features are the chaetotaxy of the dorsum which is similar to the female and the form of the spurs on legs II, III and IV.

TYPE MATERIAL. *Gamasus americanus*: Holotype ♀, South America, Balzan, slide 33/21 [ISZA]. *M. tardior*: Syntype ♀, Oxfordshire [? R. S. Bagnall] [BMNH].

MATERIAL EXAMINED. 4 collections—11 ♀♀.
ENGLAND: Isles of Scilly, Sussex, Oxfordshire.
IRELAND: Clare.

HABITATS. *Geotrupes spiniger*, also known elsewhere from compost heaps and associated with synanthropic flies.

DISTRIBUTION. Apparently practically cosmopolitan. Filipponi & Pegazzano (1960) report it from Brazil, Argentina, Uruguay, Australia, South Africa, Italy and France. It has also been reported from the U.S.S.R. (Bregetova & Koroleva, 1960, as *M. vagabundus*), Bulgaria (Balogh, 1958, as *M. vagabundus*), Germany (Krantz, 1972), Israel (Costa, 1963) and New Zealand (Emberson, 1973*a*).

REMARKS. In examining the Hull Collection, Professor G. O. Evans (*in litt.*) did not believe the specimen of *M. tardior* to be the type as it is larger than the dimensions stated by Hull. However, it is labelled from Oxfordshire, the type locality, and agrees fairly well with the description, which undoubtedly refers to a species of *Glyptholaspis*, so we see no good reason to doubt its status.

Glyptholaspis confusa (Foà)
(Fig. 20B–G, Pl. 3C)

Holostaspis confusa Foà, 1900. *Boll. Soc. ent. Ital.* **32**: 137.
Macrocheles plumiventris Hull, 1925. *Ann. Mag. nat. Hist.* (9) **15**: 216.
Macrocheles plumiventris: Evans & Browning, 1956. *Bull. Br. Mus. nat. Hist.* (Zool.) **4**: 32. *partim*, female only.
Glyptholaspis confusa: Filipponi & Pegazzano, 1960. *Redia* **45**: 154.

The female of this species has been adequately described by Evans & Browning (1956) under the name *Macrocheles plumiventris* Hull. The male described under that name is in fact a specimen of *G. fimicola.*

The only necessary additions to the description of the female are to note that there are usually one or two small glabrous or finely pilose supernumerary setae between *j6* and *J2*, that setae *J5* are

shorter than setae *Z5* and that the posterior margin of the dorsal shield between setae *Z5* is irregularly dentate with about five major teeth and many small teeth.

MALE. The sculpturing and chaetotaxy of the dorsal shield are similar to that of the female. The reticulate pattern on the holoventral shield is interrupted in the region of coxae IV. Setae *st* 1 are plumose, *st* 2–3 simple, *st* 4–5 plumose. All the ventrianal setae except the adanals are plumose.

The gnathotectum is similar to the female. The fixed chela has three teeth and the movable chela one tooth. The spermatodactyl is simple, tapered and recurved towards the tip, about as long as the movable digit.

Leg I is similar to that of the female. Leg II has sclerotized spurs on the trochanter, femur, genu and tibia. The spur on trochanter II is towards the posterior lateral surface and bears a plumose seta distally. Femur II has a number of sclerotised protuberances, including a small ventral spur with a simple seta and another spur on the posterior lateral surface at the distal margin. Genu II has a ventral spur and three other small protuberances and tibia II has a ventral spur on the distal margin and trochanter IV has three strong ventral spurs.

TYPE MATERIAL. *Macrocheles plumiventris*: A single female without habitat data in the Hull Collection [BMNH]. Hull (1925) gave 'a manure-heap in West Allendale' [Northumberland] for his solitary example.

MATERIAL EXAMINED. 8 collections—8 ♂♂, 31 ♀♀.
ENGLAND: Sussex, Essex, Hertfordshire, Middlesex, Berkshire, Buckinghamshire, Bedfordshire.
WALES: Gwynedd (Merionethshire).

HABITATS. Manure, granary refuse, leaf litter, also known from compost and associated with synanthropic flies.

DISTRIBUTION. *G. confusa* has been reported from Italy, Argentina and Australia (Filipponi & Pegazzano, 1960), Bulgaria (Balogh, 1958 as *M. plumiventris*), U.S.S.R. (Bregetova & Koroleva, 1960 as *M. plumiventris*), Germany (Krantz, 1972) and New Zealand (Emberson, 1973*a*).

Glyptholaspis fimicola (Sellnick)
(Pl. 5E)

Gamasus tardus: Berlese [*non* C. L. Koch, 1841], 1882 *Boll. Soc. ent. Ital.* **14**: 108.
Holostaspis marginatus: Berlese [*non* Hermann, 1804], 1889, *Acari, Myriopoda et Scorpiones*, etc. Fasc. 52, T. 4–5.
Nothrholaspis fimicola Sellnick, 1931. *Sber. Akad. Wiss. Wien* **140**: 765. *Nom. nov. pro Holostaspis marginatus*: Berlese [*non* Hermann, 1804,] 1889.
Macrocheles plumiventris: Evans & Browning, 1956. *Bull. Br. Mus. nat. Hist.* (Zool.) **4**: 38, male only.
Glyptholaspis fimicola (Berlese) [*sic*]: Filipponi & Pegazzano, 1960. *Redia* **45**: 139.

As suggested by Filipponi & Pegazzano (1960) the specimen described as the male of *M. plumiventris* by Evans & Browning (1956) from the Michael Collection is not conspecific with the females ascribed to that species and is the only known specimen of *G. fimicola* from the British Isles.

FEMALE. The following brief description is taken from Filipponi & Pegazzano (1960) supplemented by examination of Italian material.

Generally most similar to *G. confusa* but differing as follows. On the dorsal shield many of the setae are longer than their counterparts in *G. confusa*: *j5, j6, J2* and *z6* are similar in form and length, lightly pilose; in *G. confusa j5* is more strongly pilose than the others and erect rather than adpressed; *j6* is longer than the distance between the bases of *j6* and *z6*. *J2* is about equal in length to the distance between the bases of seta *J2*, without supernumerary setae between setae *j6* and *J2*. *J5* is about equal in length to *Z5*.

Setae *st* 1 on the sternal shield are simple, not pilose, the sculpturing of the sternal shield (Pl. 5E) is very similar to that of *G. americana*, lacking the median posterior ridge found in *G. confusa*.

The gnathotectum has the two lateral processes free, not fused as in *G. confusa* and *G. americana*. The fixed chela has four teeth and the movable chela three teeth.

The legs are very similar to those of *G. confusa*.

MALE. The male of this species has been described by Evans & Browning (1956) under the name *M. plumiventris* Hull.

The chaetotaxy of the dorsum is generally similar to that of the female, except that *J5* tends to be shorter than *Z5*. Between setae *Z5* there are five large teeth and no small teeth (Italian specimens). The pattern of the holoventral shield is not interrupted in the region of coxae IV.

The gnathotectum is similar to that of the female. The fixed chela has four teeth and the movable chela a single tooth, the spermatodactyl is longer than the movable digit, strongly recurved and pointed distally.

Leg II has spurs on the trochanter, femur, genu and tibia, the distal spur on the femur has a pilose seta terminally. There are posteriorly directed spurs on genu III, trochanter IV and femur IV, the spur on trochanter IV has a terminal pilose seta.

MATERIAL EXAMINED. 1 collection—1 ♂, A. D. Michael Collection (1930.8.25.2215).
ENGLAND: Warwickshire: Austrey. May 1892. No habitat given.

HABITATS. Known from a variety of sorts of dung and compost (Filipponi & Pegazzano, 1960).

DISTRIBUTION. Apparently only previously recorded from southern Europe, Italy (Filipponi & Pegazzano, 1960) and Greece (Sellnick, 1931).

Genus *HOLOSTASPELLA* Berlese

Holostaspella Berlese, 1903. *Redia* **1**: 241. Type species: *Holostaspis (Holostaspella) sculpta* Berlese, 1903.
Prholaspina Berlese, 1918. *Redia* **13**: 174. Type species: *Holostaspella (Prholaspina) micrarrhena* Berlese, 1916.
Areolaspis Trägårdh, 1952. *Ark. Zool.* **4** (3): 60. Type species: *Areolaspis bifoliatus* Trägårdh, 1952.

Most species are heavily sclerotised with strong ornamentation of the main shields. Dorsal shield with 28 pairs of setae, *j1* short and pectinate, usually borne on a tuberculate anterior extension of the shield; lateral region of the dorsal shield often with a series of depressions. The sternal shield nearly always has a strong median ridge; the metasternal platelets are often enlarged and fused to the endopodal sclerites. The ventrianal shield may be narrow or broad with 2–4 pairs of preanal setae (four pairs in species from the British Isles). The peritrematic shield may be fused with the expodal sclerites. Males have either a holoventral shield or separate ventrianal shields. The spermathecal apparatus is of the normal bilobed *Macrocheles* type. The gnathosoma is normal for the family. The lateral processes of the gnathotectum are free and the cheliceral brushes are shorter than the movable digit of the chelicera. Legs II in the females are armed with one or more spurs on the femora. Spurs or protuberances may also be present on the coxae, trochanters and genua, seta *mv* of tarsus II is also developed into a strong spine in all British species. Male leg armature is limited to femur II. Leg chaetotaxy is normal for the family.

Following Krantz (1962) and Petrova & Taskaeva (1964) the concept of *Holostaspella* has been considerably broadened. Filipponi & Pegazzano (1967) and Krantz (1967) have both revised the genus and split it into a number of species groups. The species from the British Isles fit into the *ornata* group of Filipponi & Pegazzano and the *sculpta* group of Krantz.

Key to species of *Holostaspella* known to occur in the British Isles

1 Dorsal shield lacking distinct depressions, setae *z1* more than half as long as *j2, j3* distinctly anterior to *z2* (Fig. 22C); female sternal shield lacking cruciform pattern . . . . . ***Holostaspella subornata*** Bregetova & Koroleva (p. 122)

– Dorsal shield with lateral depressions, setae *z1* less than half as long as *j2, j3* and *z2* more or less level (Fig. 21A); female sternal shield with cruciform pattern (Pl. 5C, D) 2

2 Seta *z1* pilose, setae *j3* and *z2* as long as or longer than the distance between the bases of *j3* and *j4* (Fig. 21A); female sternal shield as in Pls 4D, 5C . ***Holostaspella ornata*** (Berlese) (p. 120)

– Setae *z1* simple, not pilose, setae *j3* and *z2* shorter than the distance between the bases of *j3* and *j4* (Fig. 22A); female sternal shield as in Pl. 5D . . . . . ***Holostaspella exornata*** Filipponi & Pegazzano (p. 120)

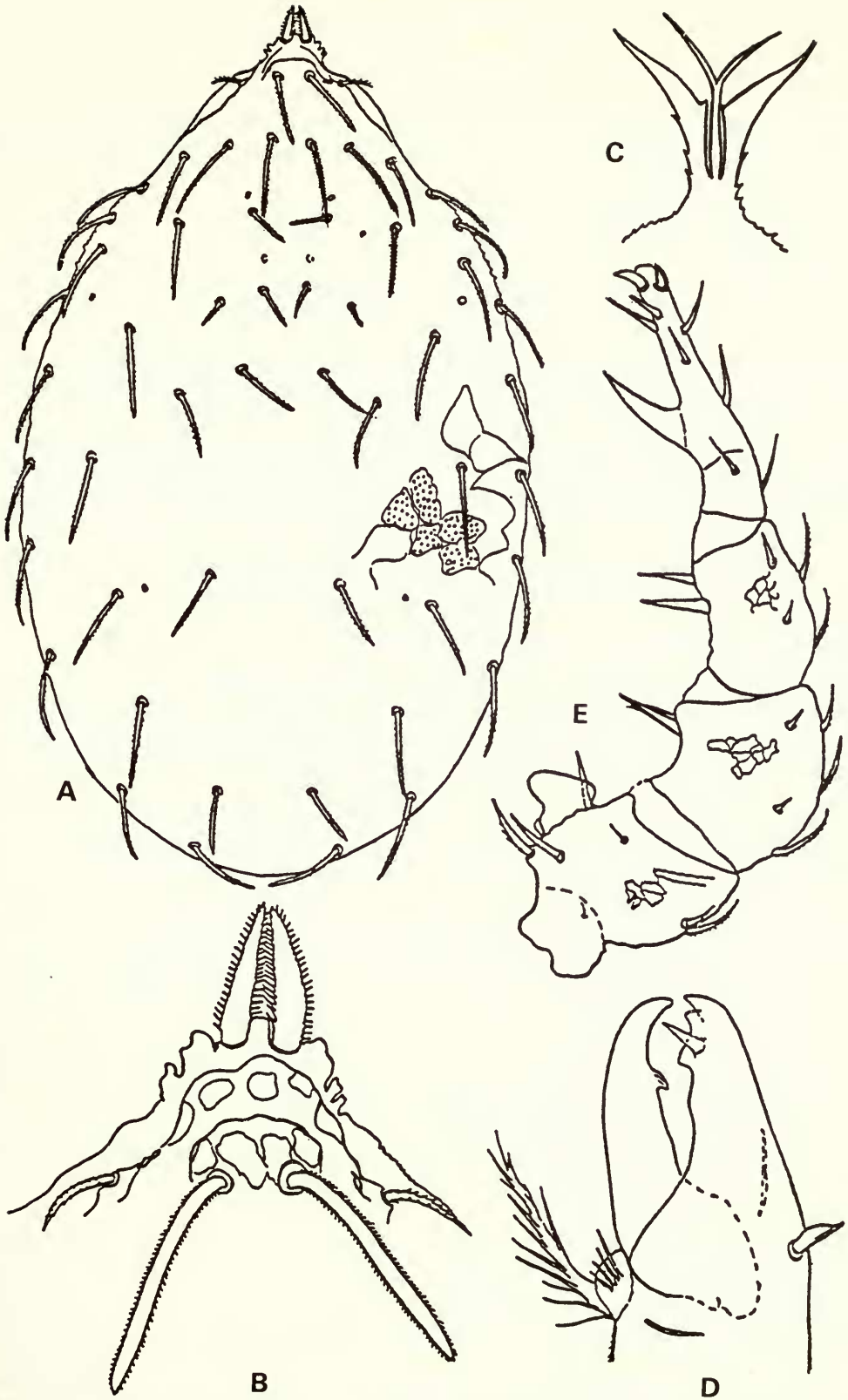


Fig. 21 *Holostaspella ornata* (Berlese): **female**—A dorsal shield; B anterior region of dorsal shield; C gnathotectum; D chelicera; E leg II, ambulacrum omitted. After Evans & Browning (1956).

Holostaspella ornata (Berlese)
(Fig. 21A–E, Pls 4D, 5C)

The description and synonymy of this species are as given by Evans & Browning (1956), the description being based on the type in the Oudemans Collection, although the British specimen they mentioned belongs in fact to the next species, *H. exornata*.

MATERIAL EXAMINED. 7 collections—12 ♀♀.
ENGLAND: Isles of Scilly, Surrey, Kent, Yorkshire, Cumbria (Cumberland).
IRELAND: Clare.

HABITATS. The first record for the British Isles. Under a board, in leaf litter, dead reeds, compost and manure.

DISTRIBUTION. A European species, Holland (Berlese, 1904), Russia (Bregetova & Koroleva, 1960), Austria (Franz, 1954), Germany (Krauss, 1970; Krantz, 1972), also recorded from Zaire (Krantz, 1967), but this could be a closely related species.

REMARKS. Filipponi & Pegazzano (1967) have suggested that some of the material assigned to this species by Bregetova & Koroleva (1960) belongs in fact to the following species. Their illustrations of the dorsal and ventral surfaces certainly appear to be of specimens of *H. exornata* and the size range overlaps those of both species as given by the former authors.

Holostaspella exornata Filipponi & Pegazzano
(Fig. 22A–B, Pl. 5D)

Holostaspella exornata Filipponi & Pegazzano, 1967. *Redia* **50**: 230.

Recorded by Evans & Browning (1956) as *Holostaspella ornata* (Berlese).

This species is morphologically extremely similar to the preceding species but differs from it consistently in a number of ways, most obviously in size, female dorsal shield length 649–800 μm as against 917–948 μm for *H. ornata* (Filipponi & Pegazzano, 1967).

FEMALE. Setae of the dorsal shield (Fig. 22A) generally shorter than in *H. ornata*, *j3* not reaching bases of *j4*, *s5* shorter than distance between *s5* and *z6*, *J5* shorter than the distance between its base and the posterior margin of the dorsal shield. Setae *j1* broadly pectinate, *z1* smooth, simple, all other setae finely pilose.

Sternal shield divided by cross-shaped ridges into quadrants, the point where the arms of the cross meet is not expanded and reticulated (Pl. 5D). Anterior margin of sternal shield with four tooth-like projections medially (smoothly concave in *H. ornata*), *st* 1 lightly pilose, other sternal setae simple. Metasternal platelets elongate, abutting endopodals. The ventrianal shield has four pairs of simple preanal setae and is ornamented with a series of small reticulations within large reticulations.

The gnathosoma is very similar to that of *H. ornata*. The fixed chela has two teeth and the movable chela one tooth. The lateral processes of the gnathotectum are free.

The legs are strongly rugose, with all segments finely granular. On leg II the femur and trochanter are armed with small spurs and tibia II has seta *mv* produced into a spine (Fig. 22B).

MALE. Not known from the British Isles, but described by Filipponi & Pegazzano (1967) from reared material.

The chaetotaxy is generally similar to the female. The holoventral shield has a strong median longitudinal ridge in the sternal region. The spermatodactyl is elongate, tapering, more than twice as long as the movable digit. Legs unarmed.

MATERIAL EXAMINED. 5 collections—9 ♀♀.
ENGLAND: Kent, London, Berkshire, Warwickshire.

HABITATS. Phoretic on *Sphaerocera* spp. (Diptera) in rotting vegetation. It is of interest to note that in two of the five collections the specimens were associated with *Sphaerocera* spp. Filipponi &

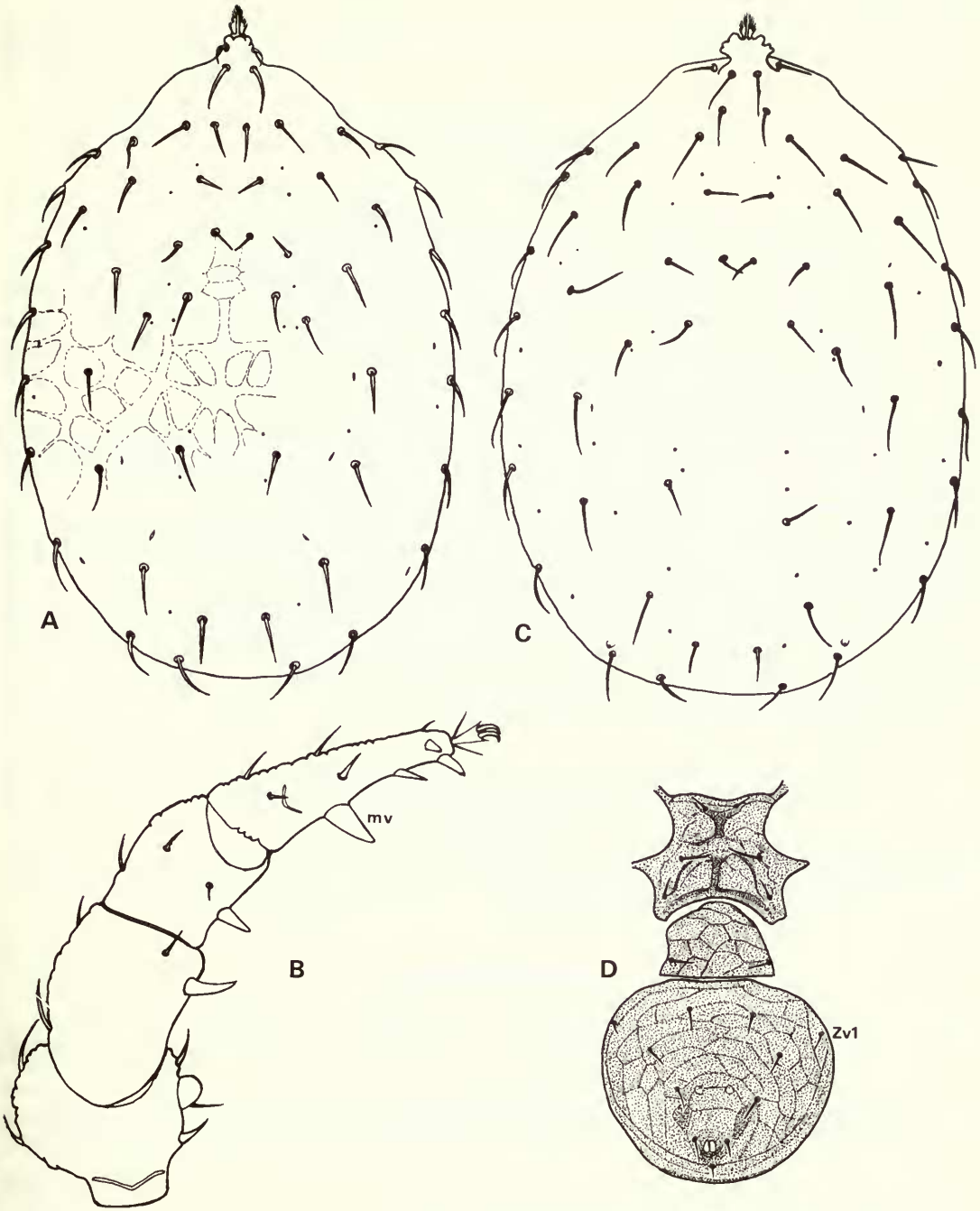


Fig. 22 *Holostaspella exornata* Filipponi & Pegazzano: **female**—A dorsal shield; B leg II. *Holostaspella subornata* Bregetova & Koroleva: **female**—C dorsal shield; D ventral sclerotisation. D after Bregetova & Koroleva (1960).

Pegazzano (1967) mention a specimen in the Berlese Collection from the nest of an ant *Acromymex lundi* in Argentina.

DISTRIBUTION. Italy, Argentina, ? U.S.S.R. Filipponi & Pegazzano (1967) suspect that some of the material reported from U.S.S.R. by Bregetova & Koroleva (1960) as *H. ornata* may be referrable to this species.

Holostaspella subornata Bregetova & Koroleva
(Fig. 22C, D)

Holostaspella subornata Bregetova & Koroleva, 1960. *Parazit. Sb.* **19**: 60

This species is generally similar to the preceding two but differs from them most noticeably in the lack of strong lateral sculpturing on the dorsal shield and in details of the dorsal chaetotaxy.

FEMALE. Dorsal shield (Fig. 22C) lacking lateral depressions, ornamented with densely packed fine punctures. Setae of the dorsal shield relatively long, as in *H. ornata*, but simple to minutely barbed rather than conspicuously pilose. Setae *j1* are broadly pectinate and in close proximity. Setae *j2* reach the bases of *j3*, *j3* are displaced substantially anterior to *z2*, so that they do not reach the bases of *j4*, *z1* are elongate, more than half as long as *j2*.

The sternal shield (Fig. 22D) is punctate reticulate, lacking the cruciform pattern of *H. ornata* and *H. exornata*, and the anterior margin is smoothly concave. All the ventral setae are simple. The metasternal platelets are barely separated from the posterior corners of the sternal shield and the endopodals. The genital and ventrianal shields are punctate reticulate.

The gnathosoma is very similar to the other species of *Holostaspella*. The fixed chela has one major and two minor teeth and the movable chela one tooth. The lateral processes of the gnathotectum are free.

The legs are rugose and all segments covered in fine granulations. Leg II has small spurs on the trochanter and femur and seta *mv* on the tibia is produced into a spine.

MALE. Unknown.

MATERIAL EXAMINED. 1 collection—1 ♀.
IRELAND: Clare.

HABITAT. The first British record. Amongst grass roots. Bregetova & Koroleva report this species from leaf litter and associated with the musk-rat *Ondatra zibethicus*.

DISTRIBUTION. Only otherwise known from the Leningrad and Omsk regions of the U.S.S.R. (Bregetova & Koroleva, 1960).

Taxonomic Summary

(*a*) *Macrocheles analis* sp. nov. is described.

(*b*) Neotypes are designated for *Macrocheles tridentinus* (G. & R. Canestrini, 1882) and *Macrocheles terreus* (Canestrini & Fanzago, 1877).

(*c*) Lectotypes are selected for *Macrocheles submotus* Falconer, 1924, *Macrocheles matrius* Hull, 1925, *Holostaspis echinatus* Berlese, 1904, and *Holostaspis marginatus* var. *littoralis* Halbert, 1915.

(*d*) The genus *Dissoloncha* Falconer, 1923, is resurrected.

(*e*) The following new synonymy is proposed:
Macrocheles melisii Krauss, 1970, is a junior synonym of *Macrocheles nataliae* Bregetova & Koroleva, 1960.
Macrocheles bombophilus Götz, 1970, is a junior synonym of *Macrocheles rotundiscutis* Bregetova & Koroleva, 1960.

Macrocheles multisetosus Götz, 1970, is a junior synonym of *Macrocheles dentatus* (Evans & Browning, 1956).

Macrocheles tardior Hull, 1925, is a junior synonym of *Glyptholaspis americana* (Berlese, 1888).

(*f*) Species new to the British Isles:

Geholaspis (Geholaspis) aeneus Krauss, 1970.
Geholaspis (Longicheles) hortorum (Berlese, 1904).
Macrocheles rotundiscutis Bregetova & Koroleva, 1960.
Macrocheles analis sp. nov.
Macrocheles punctatissimus Berlese, 1918.
Macrocheles nataliae Bregetova & Koroleva, 1960.
Macrocheles subbadius (Berlese, 1904).
Holostaspella ornata (Berlese, 1904), *nec* Evans & Browning, 1956.
Holostaspella subornata Bregetova & Koroleva, 1960.

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